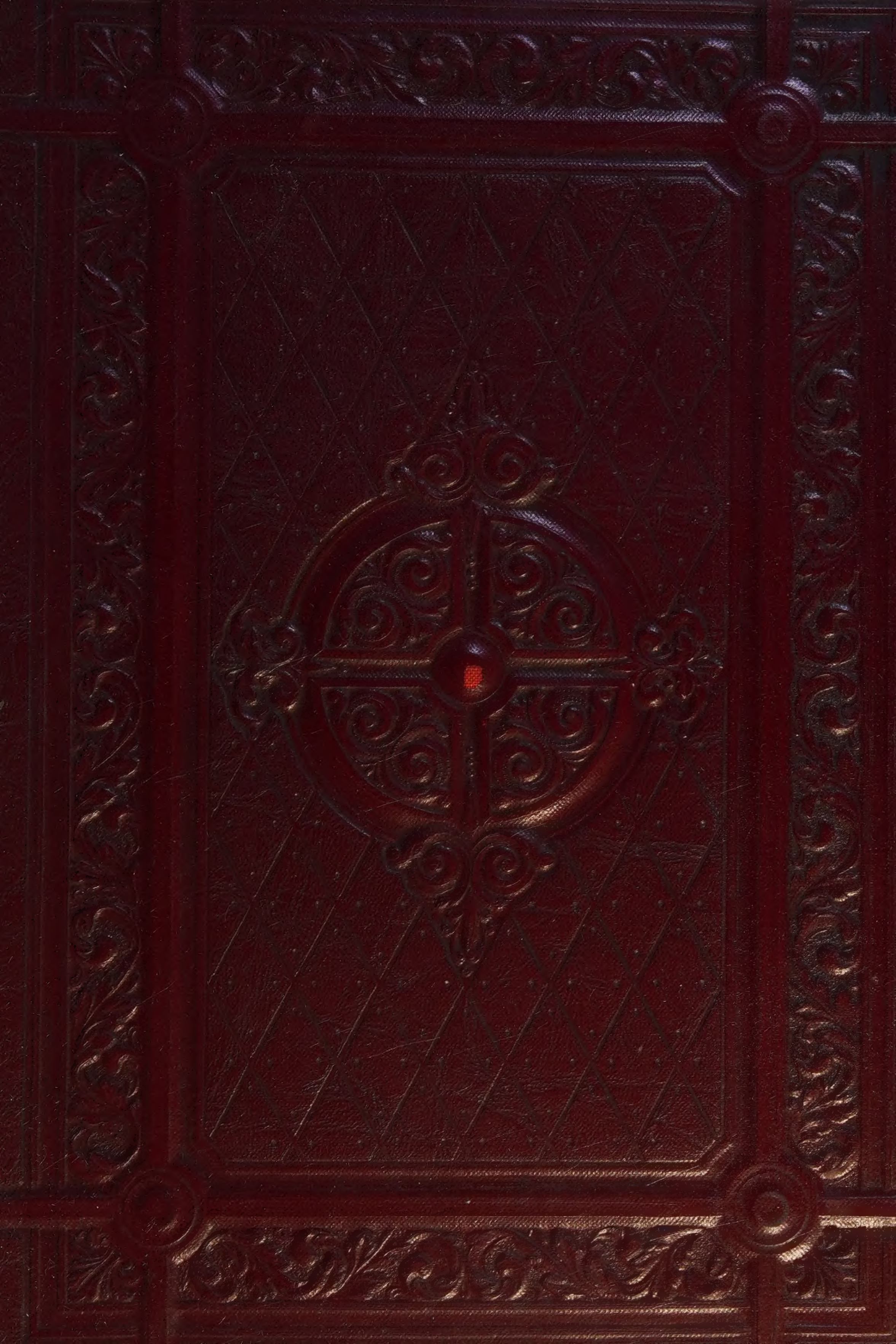

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PRONUNCIATION

Webster's International Dictionary is the authority for the pronunciation of titles. The titles are pronounced by indicating the accented syllable or by respelling according to sound, that is, phonetically.

A vowel is long when standing in a syllable which ends in silent *e* or when ending an accented syllable.

The hard sound of *c* is indicated by *k*.

S is always soft and never has the sound of *z*.

Foreign sounds which have no equivalent in the English language are represented as follows:

K for the German *ch,* as in Bach: (**Bach,** *bahK*).

N for the French *n,* as in Breton: (**Breton,** *bre toN′*).

ü for the German *ü,* as in Blücher: (**Blücher,** *blü′Kur*).

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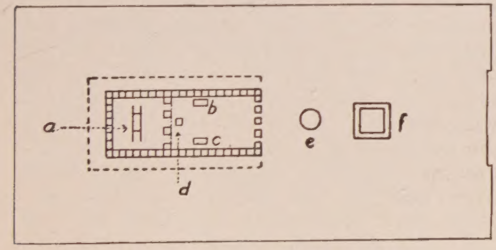
T, the twentieth letter of the English alphabet, came down to modern usage from a Phoenician symbol shaped like a cross. The Hebrew *taw,* which meant *mark,* the Greek *tau,* and the Roman *T* were much like the modern form of the letter. *T* is pronounced with the tip of the tongue placed against the upper gums or the teeth. It sounds rather like the letter *D*. *T* is silent in some combinations as, for example, in *listen* and *soften.* *T* followed by *i* may have the sound of *sh,* as in *nation,* or *ch,* as in *question. Th* may be pronounced strongly, as in *thought,* or weakly, as in *then.* See also ALPHABET.

TABERNACLE, *tab'ur nak'l,* the portable sanctuary which the Israelites carried with them during their wandering in the wilderness. This "tabernacle of the testimony," as it was called, was regarded as the meeting place between God and His people Israel. According to Exodus 25-27, 30-31, and 35-40, God commanded Moses to build the tabernacle and instructed him in detail as to its construction and furnishing.



PLAN OF THE TABERNACLE

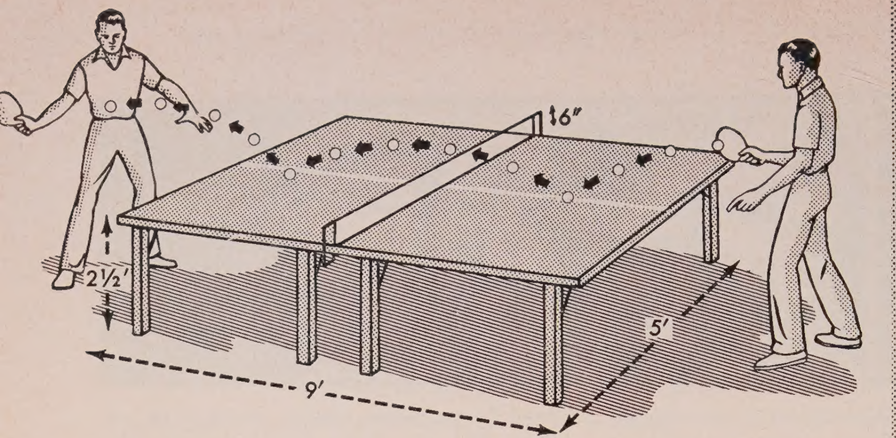
a. Ark in the holy of holies.
b. Table of shewbread.
c. Golden candlestick.
d. Altar of incense.
e. Laver, or basin for washing.
f. Altar of burnt offering.

The sanctuary, which was always placed in the center of the camp, stood in a double square court measuring 100 cubits by 50 cubits, that is, about 150 feet by 75 feet. The tabernacle was a rectangular structure, 45 feet long, 15 feet wide, and 15 feet high. The framework was of acacia wood, which was overlaid with gold and covered with tapestry and skins. One end, facing the east, was closed by a curtain, which provided the entrance. Only the priests could enter the tabernacle. A curtain divided the tabernacle into two parts, the holy place and the holy of holies. The holy place, comprising two thirds of the space, contained the table of shewbread, the golden candlestick, and the altar of incense. The holy of holies at the west end, containing the Ark of the Covenant, could be entered only once a year by the high priest. The outer court was enclosed by curtains. The eastern half of the court, in front of the tabernacle, contained the altar of burnt offering and the laver where the priests washed their hands and feet before entering the sanctuary.

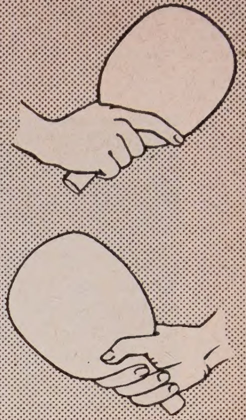
Modern scholars believe that the portable tent of meeting was much simpler than this description indicates. Such a tabernacle as described, they argue, would have been too heavy to be carried. Moreover, the early accounts make no mention of such a structure. The elaborate description apparently comes from late priestly writers who wanted to encourage sanctuary worship and is probably derived from the two historic temples and from Ezekiel's vision of the ideal temple.

TABERNACLES, FEAST OF, a Jewish festival beginning on the fifteenth day of Tishri, the seventh month of the Jewish calendar, five days after the Day of Atonement (Yom Kippur); it lasts for seven days and is followed by a day of special celebration. The Feast of Tabernacles is also called, in the Bible, the Feast of Ingathering (Exod. 23:16), coming as it does at the close of the harvest in autumn. According to Leviticus 23:42, the Jews were commanded to live in booths (*sukkoth*) for these seven days, commemorating the time when their forefathers dwelt in rude shelters in the wilderness. These booths were constructed of tree branches in the gardens or courts of houses, on the roofs, and in the court of the Temple. Since the destruction of the Temple (586 B.C.), the services attending this feast have been conducted in individual synagogues.

TABLE TENNIS, or **PING-PONG,** a variation of tennis, is one of the most widely played of all games. Although not too strenuous, it requires quick footwork and no little

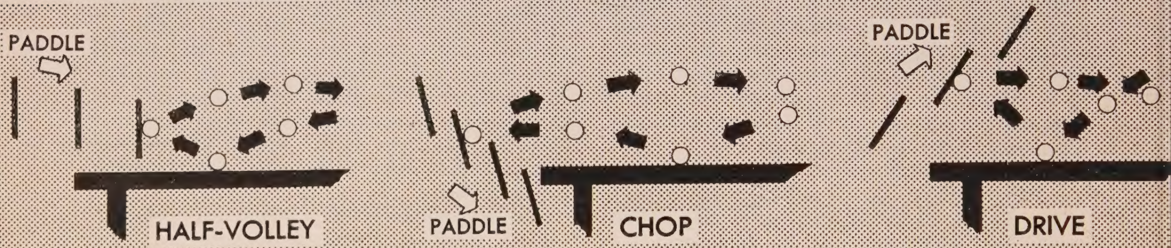


THE SERVE IN TABLE TENNIS must strike the table on the server's side of the net, clear the net, and then strike the table on the opponent's side. Above, the server is on the right.



THE SAME GRIP is used in table tennis for both the backhand stroke (top) and the forehand stroke (bottom).

IN THE HALF-VOLLEY, shown below, the paddle is swung forward, striking the ball squarely. It is swung down in the chop stroke, up in the drive, striking the ball at an angle.



skill in hitting a small celluloid ball over a net stretched across a table.

Table tennis began in the 1880's in England, and after a period of popularity in the early 1900's it faded out, except in Middle Europe, where Czechs and Hungarians long excelled at the sport. However, it was revived in the 1920's, first in Europe and then in the United States and Canada. Today many tournaments are staged, and national and international play attracts good performers.

The table on which the game is played is 9 feet long, 5 feet wide, and 2 feet 6 inches high. The net rises 6 inches above the table top, and the hollow celluloid balls are about 4½ inches in circumference. The rackets or paddles, usually made of plywood, are about a foot long and have sanded or pebbled rubber surfaces which help give spin to the ball.

The server must hit the ball so that it first bounces on his side of the net. The ball must be hit, in playing, so that it bounces once on the opposing court before being returned. When one side hits the ball so that it goes into the net or fails to bounce on the opposite court, it loses a point. Twenty-one points comprise a game. Each player serves, in turn, until five points have been made. In doubles play, partners alternate in returning the ball.

TABOO′, or **TABU**, a prohibition based on custom, superstition, or religion. The word is Polynesian and means sacred or restricted. The Polynesians, like all primitive peoples, believed that certain persons, animals, places, relationships, or things possessed magical power for good or for evil, and that they must either be avoided entirely or dealt with according to a special ritual. The people did not think of a taboo as a law carrying a kind of impersonal punishment for violators. They believed that anyone who violated a taboo would bring down immediate and fearful retaliation upon himself and perhaps on all of the people.

An animal sacred to a tribe or clan is always taboo as food to every member of the group. In some societies a man may not look at his mother-in-law or speak to her. A person who is taboo makes all that he touches taboo, and generally he must be purified by ritual before the taboo can be lifted. A taboo may be permanent or temporary, individual or general, private or public. As long as a taboo is useful to a society, it is generally observed. When it becomes a disadvantage, the people usually manage to find a way of getting around it. Priests, medicine men, and kings or chiefs, being powerful themselves, could take steps to counteract the power of the taboo by the use of rituals. The ruling group in a society sometimes used the taboos as a means of controlling the people, but even the rulers themselves were often hedged in by unbreakable taboos.

TABRIZ, *tuh breez′,* IRAN, the second largest city of the country, is situated about sixty miles south of the Russian border in the province of Azerbaijan. It lies at an elevation of about 4,400 feet with mountains on three sides. Most of the city consists of squalid huts and narrow, winding streets, but the outlying sections have attractive homes with beautiful gardens and orchards. Among the features of the city are the bazaars, the Blue Mosque, which was built in the fifteenth century, and the ancient citadel, known also as the Ark. Tabriz was for many centuries an important point on the caravan route between Europe and Persia, but the opening of the Suez Canal diverted much of this commerce. The city now has a profitable trade in dried fruits, rugs, hides, cotton, and silk. Tabriz has railway connection with the Caucasus railroad system of Russia. Throughout its long history Tabriz has suffered from many earthquakes and repeated invasions, including one by Tamerlane in 1392. Since 1730 it has been almost continuously under Persian (now Iranian) rule. It was captured first by the Turks and then by the Russians in World War I; during World War II it was occupied by the Russians, who finally retired in 1946 under the pressure of world opinion. The population, overwhelmingly Moslem and largely Turkish-speaking, numbers about 214,000.

TACHE, *ta sha′,* SIR ETIENNE PASCAL (1795-1865), Canadian statesman, was born at St. Thomas, Quebec. He served in the Canadian militia during the War of 1812, and later he practiced medicine. He was elected to the legislative assembly in 1841, when Upper and Lower Canada (Ontario and Quebec) were united; and after holding various governmental posts he became premier in two Taché-Macdonald ministries (1856-57 and 1864-65). In 1864 he presided at the Quebec conference which led to the federation of Canada, but he died before the union was completed in 1867. He was knighted in 1858. See also MACDONALD, SIR JOHN A.

TACITUS, *tas′ih tus,* [PUBLIUS] CORNELIUS (55?-120?), a Roman historian and statesman, and one of the world's great writers. Except for a few facts gleaned from letters written to him by his friend the younger Pliny and from his occasional references to himself in his writings, little is known about his personal life. Even his given names and the dates of his birth and death are in doubt. His family was probably a noble one, for Tacitus held various important public offices during his life, and in 77 or 78 he married the daughter of the celebrated general and statesman Gnaeus Julius Agricola.

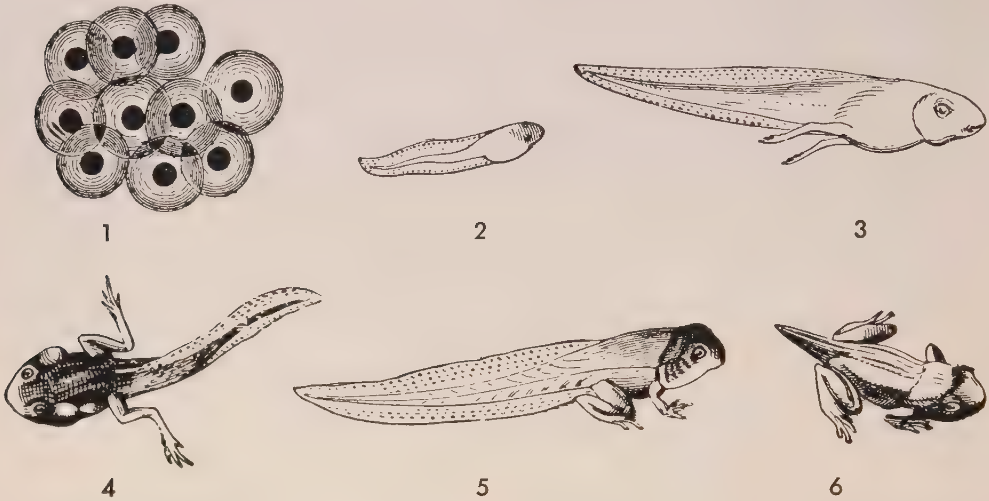
Tacitus lived through a turbulent period of Roman history which culminated with three years of terror under Domitian. He published a dialogue on oratory in 80; but his chief works, the *Histories, Annals, Germania,* and the life of his father-in-law, Agricola, appeared after Domitian's death. Tacitus was probably in Germany for some time, on official business, and gathered his material on the German tribes at first hand. The *Histories,* of which the first four books and some chapters of the fifth have survived in a manuscript discovered in the fifteenth century, cover the year 69 and a part of 70. The *Annals,* which were probably in sixteen books, of which those numbered from seven to ten are missing, covered Roman history from the death of Augustus to that of Nero. These, with the biography of Agricola, give a remarkable picture of Roman life in the first century. Tacitus, a man of high principles, believed in the republican form of government. He was a master of Latin style.

TACOMA, *tuh ko′muh,* WASH., situated on Puget Sound about twenty-five miles southwest of Seattle, is known as the "Lumber Capital of America." It is also noted for its magnificent natural vistas, which include the Olympic Mountains to the northwest, the Cascades on the east, and Puget Sound on the west. Dominating the landscape on clear days is majestic, snow-capped Mount Rainier, which reaches 14,408 feet into the sky. Tacoma's harbor, formed by Commencement Bay and the Puyallup River, is called one of the five best natural harbors in the world. Besides being a great world port, Tacoma is the terminal of two trunk-line railroads, is linked with two other railways, and has two major airlines. The city has exceptionally cheap power from Bonneville and Grand Coulee dams.

Tacoma's manufactures include sashes and doors, plywood, furniture, paper pulp, and other lumber products. In addition, the city has one of the world's largest smelting plants, it is a center for the manufacture of electrochemicals and electrometals, and it is an important flour-milling point. Shipbuilding is an important industry. Factories and canneries process the fruit and other produce of the rich farming region. The railroad shops and the foundries are also important in the city's economy. Near Tacoma are four important military establishments: Fort Lewis, McChord Field, Mount Rainier Ordnance Depot, and Tacoma Naval Station.

Tacoma is an inviting vacation land. Mount Rainier National Park and Olympic National Park are both nearby. The city itself has many attractions, such as Point Defiance Park, which is famous for its virgin forest wilderness and its rose gardens. An interesting feature is the Alaskan totem pole, 105 feet in height, the highest in the world. The cultural institutions include the State Historical Society and the Chinese Museum. Tacoma is the seat of the College of Puget Sound and of Pacific Lutheran College.

The Hudson's Bay Company built Fort Nisqually (now restored) in 1833. The settlement of Tacoma began in 1852; its development was rapid after 1887, when the Northern Pacific Railroad reached the bay. Tacoma was chartered as a city in 1883. It is the seat of Pierce County and has a population of about 143,000.



FROM EGG TO FROGLET. The successive stages in the development of a tadpole are pictured here.

TACONIC, *tuh kon′ik,* **MOUNTAINS,** a range of mountains forming a part of the boundary between New York and Massachusetts and extending northward into Vermont, where they connect with the Green Mountains (see Green Mountains). The Taconic range is an eastern extension of the highlands of the Hudson. The mountains are low, with rounded tops, and their sides are generally covered with forests or cultivated fields.

TAD′POLE, the larval stage in the life history of such amphibians as frogs and toads. Every spring the female amphibian deposits its eggs, usually several thousand in number, in the quiet waters of ponds, streams, or small lakes. The eggs hatch into tiny fishlike creatures called tadpoles or "polliwogs." Each tadpole appears to be encased in a jellylike substance. It breathes through fringelike gills, propels itself through water by means of its wriggling tail, and gobbles food through rudimentary horny beaks. Within a short time a remarkable change takes place. Hind legs begin to appear, followed by the budding of forelegs. The tail gets shorter and shorter until it is completely reabsorbed into the body. The external gills give way to internal lungs. When this metamorphosis is completed, the newly developed amphibian is ready to live on land. See also Amphibians; Frog; Toad.

TADZHIK, *tah jik′,* **SOVIET SOCIALIST REPUBLIC.** See Union of Soviet Socialist Republics.

TAF′FETA is a rather thin, crisp fabric made with twisted yarns of silk, rayon, or nylon in a plain weave with a fine horizontal rib. Metallic weighting is often used to give it stiffness. The fabric is usually woven in plain colors, but changeable taffetas are made by using one color in the warp and another in the filling. Taffeta is a popular material for dresses, blouses, linings, and draperies.

TAFT, Lorado (1860-1936), American sculptor, teacher, and author, was born in Elmwood, Ill., and graduated from the state university. After studying at the École des Beaux-Arts in Paris, he established his studio in Chicago. In addition to executing commissions, he taught at the Art Institute and the University of Chicago, and he did much to stimulate interest in art. His portraits and fountain pieces, traditional in character, were very popular. Among his works in Chicago are the "Fountain of the Great Lakes," the "Fountain of Time," and "Solitude of the Soul." He also did the Soldiers' Monument in Oregon, Ill., and the large statue popularly called "Black Hawk" which stands on a bluff above the Illinois River near Oregon.

TAFT, Robert Alphonso (1889-1953), American statesman, was born in Cincinnati, Ohio, the son of William Howard Taft. He studied at Yale and Harvard, and then began to practice law in Cincinnati. During World

Art Institute of Chicago

THE DRAMATIC FLOW of Lorado Taft's sculpture is revealed in this detail from his "Fountain of Time" in Chicago.

War I he was with the national Food Administration, and later he went to Europe with the American Relief Administration. He served in the Ohio lower house (1921-26) and in the state senate (1931-32). In 1938 he was elected to the United States Senate and was re-elected in 1944 and 1950. In 1950 he overwhelmingly defeated a candidate endorsed by labor leaders who resented his sponsorship of the Taft-Hartley Act. His strong opposition to the New Deal and the Fair Deal won him the nickname "Mr. Republican." Taft was a leading candidate for his party nomination for President in 1952. As majority floor leader in the Senate, he loyally supported President Eisenhower.

TAFT, William Howard (1857-1930), twenty-seventh President of the United States and later Chief Justice of the Supreme Court, is usually listed among the less distinguished American Chief Executives. His record indicates, however, that he was honest and able, that despite his natural conservatism he was not a reactionary, and that, in certain respects, he actually accomplished more than his famous predecessor, Theodore Roosevelt.

Early Years. Taft was born in Cincinnati, Ohio, on September 15, 1857. His father, Alphonso Taft, after achieving success as a lawyer, served as Secretary of War and Attorney General in Grant's Cabinet and then as minister to Austria-Hungary and Russia. He had two sons by his first wife, who died in 1852; a year later he married Louisa Torrey, who became the mother of William Howard Taft and four other children. Both parents came of old New England families.

Will Taft, as he was called, was inclined to stoutness from childhood; he had blue eyes, fair hair, and a sunny disposition. He attended Yale, his father's alma mater, where he was admitted to the highest honor society and was graduated second in his class in 1878. After two years' study at the Cincinnati Law School he was admitted to the Ohio bar in 1880. He was a huge young man with a first-class mind but with little inclination to exert himself. Although too contented to be particularly ambitious, he was soon active in Republican party affairs.

In 1881 Taft was made assistant to the county prosecuting attorney, and the next year President Arthur appointed him collector of internal revenue for the Cincinnati district. The special favors shown him resulted from his father's political prominence, his own wide circle of friends, and his efficient work in his own ward.

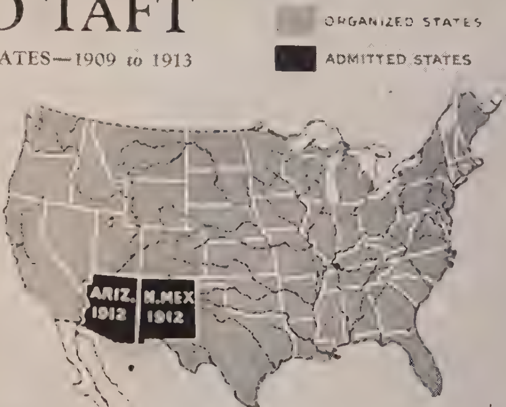
Progress in the Courts. Taft resigned from the internal revenue department in 1883. After two years of private practice and travel in Europe he was appointed assistant solicitor for his county. In 1886 he married Helen Herron, a strong-minded, ambitious woman who helped her husband to overcome his natural diffidence toward advancement. In 1888 he was elected for a five-year term as a member of the superior court of Ohio.

Taft hoped for an appointment to the Supreme Court, but instead, in 1890, President Harrison made him Solicitor General of the United States. For two years he lived in Washington, acting as legal adviser to the Attorney General and representing the government in cases before the Supreme Court. In this period he made many friends among the prominent statesmen. In 1892 he accepted the post of circuit judge in the Sixth Judicial Circuit, with the added duty of sitting in the newly established circuit court of appeals. Later, when he was President, Taft was taken to task by organized labor for certain judgments against labor groups which he made while on the Ohio and later the circuit-court bench. Unlike many in his social circle, however, Taft recognized

THE ADMINISTRATION OF
WILLIAM HOWARD TAFT

TWENTY-SEVENTH PRESIDENT OF THE UNITED STATES—1909 *to* 1913

CARTOON: TAFT CARRIED THE ROOSEVELT BANNER



PANAMA CANAL, ONE OF THE WONDERS OF THE WORLD

FORD'S MODEL "T," LOW-PRICED CAR OF THE MASSES

Few have come to the Presidency as well prepared by experience. Few regimes have been so bare of great results. The America over which Taft would preside was one awakened to progressive thought, demanding action. The day when the people would reckon with their government had come. The old order stood challenged; the new must be tried.

The belligerent radical labor movement was threatening the expanding power of organized capital. Progressives in both parties were dissatisfied with the administration's legislative policies and the Democrats made important gains in the Congressional elections of 1910. Political and economic insurgency grew. The "Bull Moose" Progressives organized to liberalize the government. Though abortive, the revolution of 1912 revealed a current social idealism which was not yet vital enough to swing an election. In this era, woman suffrage was extended, but the true emancipation of woman came through enlightenment, labor-saving devices, release from drudgery, and the enlargement of her special privileges.

POPULATION, 1910, 91,972,266.

PEARY PLANTED THE U.S. FLAG AT THE NORTH POLE, APRIL 6, 1909 the right of labor to organize and was not unfriendly to unions in themselves.

Governor of the Philippines. After eight years as circuit judge, Taft reluctantly agreed to serve as head of the five-man Philippine Commission which President McKinley was sending to establish civil government in the Islands. Native resistance was still going on when he arrived in the Philippines, and the army command offered the Commission little co-operation. In 1901, however, Taft was made governor, and the military was made subordinate to the civil authority. Showing sympathetic understanding, which in time won him the affection of the native population, the stout administrator introduced partial self-government as soon as his charges showed capacity for it. Under his authority roads were built, schools and municipal governments established, and various health measures inaugurated. Taft persuaded Congress to lower tariff duties on Philippine products. He was an excellent governor, but by 1902 he had worked himself into a state of collapse. Nevertheless, after a visit to the United States for treatment, he returned to his post, stopping off at Rome on the way and successfully negotiating for the purchase of territory in the Islands owned by Catholic religious orders.

Brown Brothers

HELEN HERRON TAFT, called Nellie by her devoted husband, did much to further his career.

Taft and Roosevelt. While in the Philippines, Taft twice declined offers of appointment to the Supreme Court, but in 1904 he was recalled by President Theodore Roosevelt to become Secretary of War. His legal knowledge, his prestige as governor of an overseas dependency, and his experience with Far Eastern problems strengthened the administration on the eve of the political campaign of 1904. Giving good service, Taft soothed tempers raised by high-handed American tactics in Panama and discovered the engineer George W. Goethals, whom the President placed in charge of construction of the Panama Canal. He visited the Philippines, Japan, Puerto Rico, and Cuba and suggested government action as the only solution to the Cuban problem. In domestic affairs his role was that of conciliator, adviser, confidant, and administration handy man.

Taft's engaging personality made him a close friend of the President. After Roosevelt announced in 1904 that he would not seek another term, Taft was his choice for the succession. Still preferring a place on the Supreme Court and doubting his fitness for the office of Chief Executive, Taft urged Roosevelt to reconsider his own withdrawal, but finally, giving in to his wife and his brothers, he agreed to run. Roosevelt managed his nomination, and in November, 1908, he received almost twice as many votes as Bryan, the Democrat. James S. Sherman of New York became Vice-President. The Republican victory was an endorsement of the Roosevelt policies. Taft pledged himself to follow these policies — a commitment which he was un-

Major Events During the Taft Administration

World Affairs		*Domestic Affairs*
	1909	Tariff law offends Progressive Republicans. Conservation dispute: Pinchot vs. Ballinger.
	1910	Publication of campaign expenses ordered. House rules reformed. Interstate Commerce Commission strengthened. Postal Savings Banks established.
Mexican Revolution. Díaz overthrown. Second Moroccan crisis. Italo-Turkish War, 1911-12.	**1911**	Antitrust suits. Standard Oil dissolved. Children's Bureau established. Nonintervention in Mexican Revolution.
Chinese Republic set up. Balkan Wars, 1912-13.	**1912**	Parcel post established. Intervention in Nicaragua. New Mexico and Arizona admitted. Wilson elected over Taft and Roosevelt.
	1913	17th Income Tax Amendment adopted.

able to fulfill. See ROOSEVELT, THEODORE.

The Administration of Taft, 1909-1913

Handicapped by having to follow a spectacular personality and by failing to gain the goodwill of the Washington correspondents, Taft gradually became associated in the public mind with the conservative Old Guard faction of the party, which had opposed Roosevelt's liberalism. He refused to aid the Progressive Republicans in the fight against reactionary, dictatorial "Uncle Joe" Cannon, the Speaker of the House; and he gave high praise to the conservative Payne-Aldrich Tariff Act of 1909, which many considered a deliberate abandonment of campaign promises of tariff reform (see TARIFF).

Accomplishments. On the other hand, Taft recommended the Congressional resolution referring a proposed income-tax amendment to the states, secured the passage of the first comprehensive national budget, and induced Congress to vote funds for a commission to investigate the need for reorganization in the executive department. In 1912 he urged the establishment of a budget bureau similar to one authorized a decade later.

Taft proposed other reforms also, which indicate that he had not betrayed the liberals. Congress passed the Mann-Elkins Act of 1910 enlarging the powers of the Interstate Commerce Commission; established postal savings banks and the parcel-post system; and authorized a national health bureau and a Federal Children's Bureau. Laws were enacted providing that campaign contributions be made public and that Federal injunctions be used only in certain specified circumstances. Reforms authorized by executive order extended the merit system in the postal department and in the consular and diplomatic services. Trade reciprocity with Canada, one of the President's most cherished measures, was provided in a treaty which he induced the Senate to pass but which was defeated in the Canadian Parliament in 1911.

Under Taft more trusts were prosecuted and more were dissolved than under Roosevelt. Taft's record in conservation was also excellent, but his Secretary of the Interior was accused of serving the interests of powerful corporations. Although a Congressional investigation cleared the Secretary of the charges, the incident provided further ammunition for those who claimed the President was on the side of Big Business, as the large business interests came to be called.

Foreign Affairs. In the Far East the government continued to insist upon the maintenance of China's integrity and the Open Door policy. At the request of American bankers it demanded that they share in a loan to the Chinese Government made by the United States, Germany, France, and Great Britain. This move exposed the administration to the charge of "Dollar Diplomacy" made earlier against Roosevelt, that is, using the power of the Federal Government to further private American interests abroad. In the Caribbean area the United States continued to intervene in native republics in accordance with the "Roosevelt Corollary" to the Monroe Doctrine; this was a policy, first started by Theodore Roosevelt, of preventing intervention in Latin America by European creditor nations. When Díaz was overthrown in the Mexican Revolution of 1911, Taft sent troops to the border but rejected the demands of American oil men and other corporate interests for intervention.

Dissention and Defeat. Taft's alleged departures from Roosevelt's policies caused a coolness between the two men which Taft was unable to dispel. Returning to politics, Roosevelt attacked the Taft administration, expounded his own political philosophy, which he termed "New Nationalism," and became the leader of the Progressive Republicans. He announced his candidacy for the Republican nomination in 1912, but Taft was renominated by the party convention. Claiming that he had been robbed by the Republican bosses, Roosevelt then became the Progressive, or Bull Moose, party candidate. Under the circumstances, the Democrats easily elected their candidate, Woodrow Wilson. Taft, running a poor third, carried only Utah and Vermont.

Later Career

Although he had refused an offer of the presidency of Yale in 1899, Taft now accepted a position on the faculty of the Yale Law School. As President he had been deeply disappointed by the defeat of two model arbitration treaties with Great Britain and France; as a private citizen he continued to work for world peace. Although he supported Wilson in the early years of World War I, he later became critical of the President's policies and opposed his re-election.

In 1918, after America entered the First World War, Taft joined the War Labor Board as a representative of employers; in practice, however, he frequently sided with the workers. He favored the ratification of the Versailles Treaty and the League Covenant and sought to secure passage of the treaty, with some reservations, by the Senate. In 1921 he was made happy by his appointment as Chief Justice of the Supreme Court, his most cherished goal, and for nine years he labored happily in that high office. In general, his decisions were conservative, and he rendered valuable service by effecting changes in procedure which brought new order and efficiency. Ill-health forced him to resign on February 3, 1930. He died on

Brown Brothers

THE SINKING OF THE "TITANIC" in 1912 was one of the most tragic events of the Taft era.

March 8 and was buried in Arlington National Cemetery.

The Taft Family. Taft was survived by his children, Robert Alphonso, Helen, and Charles Phelps. His daughter, Helen Taft Manning, became dean of Bryn Mawr College; his younger son, Charles, served as president of the Federal Council of the Churches of Christ in America while carrying on a highly successful legal practice; and his older son, Robert, became a Republican leader in the Senate and a contender for the Republican nomination for President in 1940, 1948, and, most actively, in 1952.

The Taft Era

Although marked by neither sensational prosperity nor critical depression, the period of the Taft administration was by no means dull. With the admission in 1912 of New Mexico and Arizona, all of America's territory between Canada and Mexico was finally organized into forty-eight states. Farm and factory production continued to increase, as did the nation's exports. More industries were setting up agencies abroad, and more American capital was being invested in foreign enterprises. Big Business was rapidly breaking down the old isolation. Of the 92,000,000 people in the United States in 1910, millions were foreign-born, and throughout Taft's administration the annual immigration figures hovered around the million mark.

The Machine Age. Although well under 500,000 cars sputtered and stalled around the country and only a fraction of the nation's roads were surfaced, the automobile had definitely arrived. Henry Ford was already preparing to flood the nation with the benefits of mass production, and the new self-starter promised greater ease and efficiency. The airplane was beginning to attract worldwide attention. The great news of the times was the successful flight over the English Channel by a French aviator. In the United States, mail was flown, a plane successfully landed on water, and a parachutist reached earth safely. In 1911 a flight across the country was completed in two weeks. American steam locomotives were faster than ever, approaching speeds of one hundred miles an hour in the year of Taft's inauguration. Although the great bulk of America's trade was being carried in foreign vessels, the country was in all other respects keeping its place among the leaders in the new Machine Age.

Labor. Less than a third of America's working population was employed on farms, for the Machine Age was the age of factory and mill. In the nation's factories and mills, men, women, and thousands of young children labored long hours for low wages. The struggle between capital and labor, once a private conflict, was becoming a matter of public concern. In 1912 a minimum-wage law was enacted in Massachusetts, the first state to pass such a measure; and there was increased emphasis on negotiation, arbitration, and court decisions. Sympathy for the worker was widespread. Besides, politicians were well aware of the voting strength of an organization like the American Federation of Labor, which had over 1,500,000 members in 1910. At the same time, many feared the growth of union strength, especially with the expansion of the radical International Workers of the World (I.W.W.). There were whispers of an uprising of the masses.

Liberalism and Reform. The growing influence of labor, the new political strength of the West, the flourishing Progressive movement in the Middle West, and the general desire for change and reform all contributed to the liberal temper of the times — and helped to wreck Taft's chances for a successful administration. In the election of 1912 the actual contest was between two liberals, Roosevelt and Wilson. In the interest of more honest, efficient, or democratic local governments, reformers, businessmen, and Socialists were, in many different parts of the country, voted into offices formerly held by professional politicians.

The woman-suffrage movement, the prohibition movement, and all sorts of civic drives to combat slum conditions, disease, child labor, infant mortality, and juvenile delinquency gained ground in this period. The contributions of ordinary citizens and wealthy individuals and the efforts of local reform governments resulted in the opening of free clinics, the setting up of children's courts, and many other admirable developments. In these same years the Boy Scouts of America, the Girl Scouts, and the Camp Fire Girls were founded.

The American Scene. During Taft's administration American women wore "hobble skirts," which were long skirts very scant at the hem; yet they managed to dance to the new ragtime. Newspaper readers were excited by reports of Admiral Peary's discovery of the North Pole in 1909 and of the victories of the American Indian, James Thorpe, in the Olympic Games in Sweden in 1912. Some were terrified by stories of the approach of Halley's comet, and all were horrified when the great liner "Titanic" sank in 1912 after colliding with an iceberg, with the loss of 1,635 persons.

Readers of new books were baffled by the experiments of Gertrude Stein and shocked by the realism of Theodore Dreiser, but they could appreciate the polished work of Edith Wharton. Among the important poets were William Vaughn Moody, Edwin Arlington Robinson, Amy Lowell, and Robinson Jeffers. American poetry was on the threshold of a brilliant period, and the founding of the magazine *Poetry* in 1912 was an event of major importance to modern American literature. Interestingly enough, the writers, too, were breaking with old, conservative methods and seeking newer, better ways of communicating with their audiences. Thus, without wars or great national catastrophes, the Taft era was an era of excitement and change.

TAGORE, *tah'gohr,* RABINDRANATH (1861-1941), internationally known Indian author, philosopher, and teacher, was born in Calcutta, of distinguished and wealthy Brahman parents. At the age of seventeen he went to Europe to study law, but when he returned to India he began his long career as an author. His work included plays, novels, essays, and short stories as well as lyric poems full of mysticism and love of nature. He set many of his lyrics to music. Tagore received the Nobel prize for literature in 1913, and in 1915 he was knighted. He worked for the freedom of India, but he believed that social reform was even more important than political independence. The school he founded in 1901 in Bengal later developed into a university attended by students from all parts of the world. Tagore translated a number of his books into English. The best known are *Gitanjali* (1912), *The Crescent Moon* (1913), and his philosophical *Religion of Man* (1931).

TAGUA, *tah'gwah.* See IVORY NUT.

TAHITI, *tuh he'tee.* See SOCIETY ISLANDS.

TAHOE, *tah'hoh,* LAKE, on the boundary between California and Nevada, is the largest lake in the Sierra Nevada range. It is twenty-two miles long and about ten miles broad. The mountains of the two states are mirrored in the remarkably clear waters of this beautiful glacial lake. Tahoe lies at an elevation of 6,225 feet above sea level and discharges through the Truckee River into Pyramid Lake. Lake Tahoe is a noted summer resort, with fine homes and hotels.

TAILORBIRD, any of several small, active birds related to the kinglets, gnatcatchers, and Old World warblers. Tailorbirds are found in Asia, Africa, and the East Indies. Their name comes from their craftsmanship in nest building. The tailorbird uses its sharp bill as a needle to stitch together the edges of a large leaf, with fiber, grass, or string serving as thread. In this leaf sack the tailorbird places its nest. The Indian tailorbird has yellowish-green upper plumage, a patch of chestnut on the crown, and white under parts.

Scientific Name. *Sutoria sutoria.*

TAINE, *ten,* HIPPOLYTE ADOLPHE (1828-1893), a French critic, philosopher, and historian, was born in Vouziers and received

Nevada State Highway Dept.

ACROSS LAKE TAHOE from a private landing loom the mountains which frame this beautiful body of water.

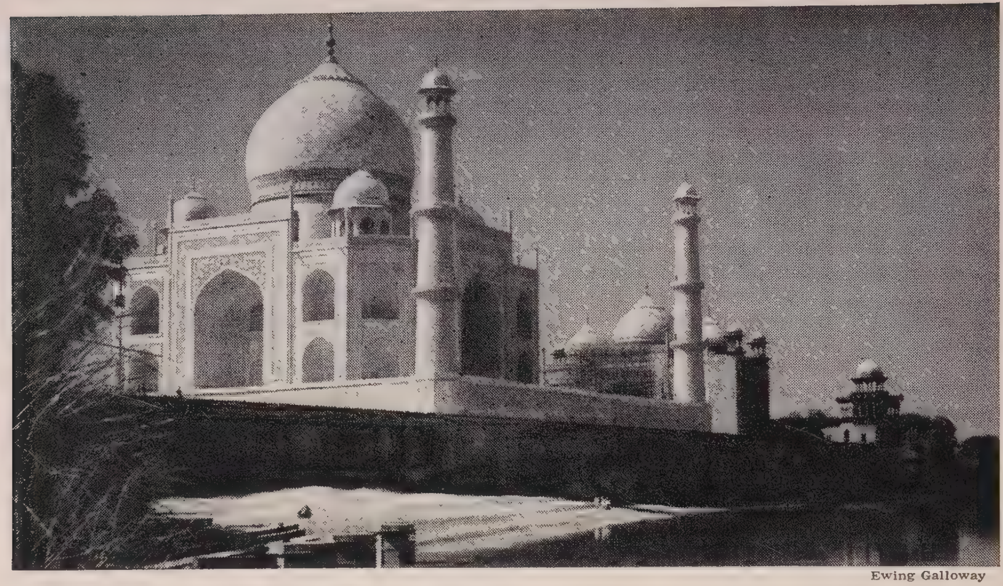
his doctor's degree from the Sorbonne in 1853. He taught for a time and gave a series of lectures at the École des Beaux-Arts in Paris, but most of his life was spent in research and writing. He was made a member of the French Academy in 1878. Taine held that each human being is the product of his race, his environment, and his particular time in history, and that his actions are determined by these factors, over which he has no control. Taine applied this doctrine of scientific *determinism* to the study of art, literature, and history. His *History of English Literature, Origins of Contemporary France, Philosophy of Art,* and *On Intelligence* are still read for their penetrating analysis and intellectual vigor. See also DETERMINISM.

TAIWAN, *ty wahn′*. See FORMOSA.

TAJ MAHAL, *tahj muh hahl′*, a magnificent marble mausoleum in the Moslem style, built in the seventeenth century at Agra in north-central India by the Mogul Emperor Shah Jahan. The Shah began its construction about 1632 as a tomb for his favorite wife, Mumtaz-i-Mahal, and it was completed some twenty years later. The Taj Mahal is one of the most beautiful buildings in the world, and its setting in the midst of gardens and pools is perfectly in keeping with its graceful and harmonious design. The mausoleum itself, of white marble elaborately carved and encrusted with semiprecious stones, is about 185 feet square, and the marble dome that crowns it is fifty-eight feet in diameter. Tall, graceful minarets mark the corners of the large court in which the building stands. Inside the Taj Mahal are monuments honoring the Shah and his wife, who are buried in a vault below the central chamber. Light enters through delicately carved, translucent marble screens that serve as windows.

TALC, a very soft mineral with a soapy feel, is found in practically all parts of the world. It is commonly gray, white, or green in color. Although talc is one of the softest of minerals, it is not affected by the common acids and many other liquids and can withstand great heat. For this reason talc and soapstone (or steatite), an impure form of talc, are used in making laboratory table tops, sinks, firebricks, fireless cookers, and electrical switchboards. High-frequency electrical insulators are made from purer grades. French chalk, a high-grade talc quarried in huge blocks, is cut up for use in making gas-burner tips and crayons for marking glass, iron, and cloth. Finely ground talc, called talc flour, is the principal component of talcum powders and is used in making soaps, lubricants, steampipe coverings, and waterproof cement and also as filler in paper, paint, and roofing materials.

While several types of talc occur in masses, *foliated* talc consists of easily separated scales or plates. In chemical composition talc is a hydrous magnesium silicate. Of the hundreds of thousands of tons produced annually, more than half originates


Ewing Galloway

THE STRIKING BEAUTY of the Taj Mahal has attracted visitors from every corner of the globe.

in the United States, chiefly in the east.

TAL′ENT, a unit of weight and money used in ancient times by Hebrews, Greeks, and many other peoples. Before the invention of coinage, which probably took place in the seventh century B.C., value was determined by weight units of gold or silver. For example, according to I Kings 10:14 the weight of gold which King Solomon received each year was 666 talents. The talent varied greatly in value and weight among the peoples. The Hebrew talent ordinarily consisted of 60 minas of 60 shekels each, or 3,600 shekels, but for the precious metals it had 60 minas of 50 shekels each, or 3,000 shekels, the weight of the shekel being 252 grains. At the current price one talent of gold would be worth nearly $50,000. In addition to the common, or *heavy,* talent, there was also a *royal* talent worth slightly more and a *light* talent of half value. The ratio between gold and silver varied, but usually it took from thirteen to fifteen talents of silver to equal one of gold. The Attic (or Athenian) talent used in the Greek states weighed about 57.85 pounds avoirdupois. Value was usually given in terms of the various silver coins; but great values were sometimes expressed in talents (of silver), as in Christ's parable of the servant who owed ten thousand talents (Matt. 18:24).

In present-day usage the word *talent* is derived from the parable of the talents (Matt. 24:14-30) and applies to a special endowment or faculty.

TALLAHASSEE, *tal uh has′ee,* FLA., the state capital, is a modern city rich in the culture of the Old South. It is situated in northern Florida about twenty miles north of the Gulf of Mexico, in a region of rolling hills and numerous lakes. Fine old homes and moss-covered oaks give character to the city. On a terraced knoll stands the state capitol, first built in 1845, with its last addition dating from 1947. An interesting building is the Presbyterian Church (built in 1832), whose slave gallery is a relic of a lost age. Tallahassee is a trading center, served by a trunk-line railroad, arterial highways, and airlines. Its industry is based on lumber, naval stores, and meat packing. Tourists are attracted by the fishing, hunting, and other recreational activities of the region.

The site was visited by Narvaez in 1528 and by De Soto in 1539. Spanish missions, established here about 1640, were maintained until they were destroyed in 1704 during a war with the English. In 1824, five years after the United States purchased Florida from Spain, Tallahassee was selected as the territorial capital because it was midway between St. Augustine and Pensacola. During the War between the States it was the only Confederate state capital east of the Mississippi to escape capture. The population is about 27,000.

TALLEYRAND-PERIGORD, *tal′ih rand-pay ree gawr′,* CHARLES MAURICE DE (1754-1838), a French statesman, ranking after Napoleon as perhaps the greatest public figure of his age. He was born in Paris, the son of a general. Prevented from entering the army because an injury to his foot crippled him for life, he was trained for the Church; although a freethinker in religion and a libertine in morality, he was ordained, and in 1789 he was made Bishop of Autun.

The French Revolution. In 1789 Talleyrand was elected to the Estates-General as a member of the estate of the clergy. Here, siding with the revolutionists, he advocated the merging of his clerical estate in the new National Assembly, proposed the confiscation of the Church lands, and helped draft the Declaration of the Rights of Man and of the Citizen. In 1790 he became president of the National Assembly, and the next year he resigned his bishopric and was excommunicated by the Pope. He was sent to Great Britain in 1792 on a diplomatic mission; later that year he went back to England to escape the Reign of Terror. Expelled from England when that country went to war with France in 1794, he went to the United States, where he lived in exile until 1796, when he returned to France. The next year he became Minister of Foreign Affairs in the government headed by the Directory, and in this capacity he became involved in the XYZ affair with three American envoys to France (see XYZ CORRESPONDENCE).

The Napoleonic Period. Talleyrand resigned his office in 1799 and soon afterward helped Napoleon Bonaparte overthrow the tottering Directory. When Napoleon was made first consul under the new regime, he was recalled to his former office, and when the Corsican assumed the title of Emperor in 1804 Talleyrand became grand chamberlain of the empire; in 1806 he was made Prince of Benevento. Although he was a very useful executor of Napoleon's policies, he became increasingly opposed to the grandiose schemes which led eventually to disaster. After the Peace of Tilsit (1807), between France and Russia, he resigned from office and, while remaining a member of the imperial council, engaged in intrigue with Napoleon's opponents. After the disastrous Russian campaign of 1812 Talleyrand became the center of opposition to the regime, and in 1814, after the Allies had captured Paris, he took the leadership in securing Napoleon's abdication.

The Restoration. Talleyrand led the movement which restored the Bourbon monarchy, and Louis XVIII rewarded him for this service by making him Minister of Foreign Affairs. As French representative at the Congress of Vienna (1814-15) he skillfully maneuvered to split the former enemies and to gain many concessions for France (see VIENNA, CONGRESS OF). Nevertheless, he was forced to resign in September, 1815, after the Treaty of Paris, because of the opposition of the old nobility. He remained in retirement until the Revolution of 1830 brought the Bourbon Louis Philippe to the French throne. He declined his old office but accepted the post of ambassador to Great Britain. Shortly before his retirement in 1834 he negotiated the Quadruple Alliance of Great Britain, France, Spain, and Portugal. He became reconciled with the Catholic Church before his death. Talleyrand displayed statesmanship of the highest order, but he marred his career by his venality and his unscrupulous methods. See also FRANCE, *History;* NAPOLEON I.

Brown Brothers

THE BRILLIANT TALLEYRAND was a leading actor in the political drama of the Napoleonic era.

TALLOW, *tal'oh,* the hard, white fat of cattle and sheep, is obtained by the rendering of fatty parts in closed steam tanks, followed by cooling and purifying. It is a mixture of two solid fats, stearin and palmitin, and a liquid fat, olein. Tallow is extensively employed in the manufacture of soap, candles, dressings for leather, and lubricating greases. The best tallow, taken from the kidneys and loins of healthy beef carcasses, is used in making oleomargarine.

TALLOW TREE, any of several trees of the spurge family which produce a tallow-like substance used for making candles. One of the largest, most beautiful, and most widely distributed is the tallow tree of China, which has provided material for candles since very ancient times. Growing to a height of about twenty-five feet, it now flourishes also in coastal areas of the southern United States. To obtain the tallow, or wax, the capsules and seeds of the tree are crushed together and boiled; the

Bettmann Archive

THE MIGHTY TAMERLANE ENTHRONED is depicted in this miniature from an Indian manuscript.

fatty matter is skimmed as it rises, and it is condensed by cooling. A soap with a pleasant odor is also made from this material. The large leaves of the tallow tree, which turn a handsome red in early winter, furnish a black dye; the stem yields *copal,* a resinous substance used in making varnishes and lacquers.

TAL′MUD, the compilation of Jewish Oral Law supplementing and expounding the Torah, the written Mosaic law which is found in the first five books of the Old Testament. Strictly speaking, it is a cyclopedia of Jewish life as well as a compilation of Jewish law. The Talmud consists of two parts: the *Mishna,* in Hebrew, and the *Gemara,* in Aramaic. The *Mishna* is the text of the traditional Jewish law which grew out of the decisions and discussions of many generations of scribes; it was finally compiled in the third century A.D. The *Gemara,* which was written down soon after A.D. 500, underwent a similar development as a commentary on the *Mishna,* which it supplements. Yet it is much more than a legal commentary; it is also a collection of Jewish knowledge and folklore, containing theology, philosophy, ethics, history, astronomy, science, and many diverse items of information and speculation.

The Talmud appeared in two versions, the Babylonian and the Palestinian, the former being the fuller and more authoritative. It has been translated into many languages.

TA′LUS, the sloping rock heap formed at the base of a disintegrating cliff by rock fragments fallen from the cliff face. Rocks are loosened in several ways, but particularly by the freezing and thawing of water in the crevices or by the action of plant roots that push into cracks. They fall to the foot of the cliff, and gradually the talus is built up. The most recent falls, which are usually blocks or coarse rock fragments, lie near the top of the slope. At the lower end, the older, decomposed rock pieces are finer. The whole talus has a tendency to creep, or to move very slowly downward. The word talus is also applied to the slope of an earthwork fortification.

TAMARACK, *tam′uh rak.* See LARCH.

TAMARIND, *tam′uh rind,* a large, beautiful evergreen tree which grows in tropical regions of Asia, Africa, and the Western Hemisphere. In the United States it flourishes in southern Florida. Reaching a height of eighty feet, the tree bears clusters of yellow flowers and bears fruit in the form of long pods, which contain seeds and a brown pulp. The pulp is used in making cooling drinks, and seeds and pulp together are made into preserves and other edibles. The seeds are also used to make dye, and the hard wood is sometimes used in cabinetmaking. The tamarind tree belongs to the pea family.

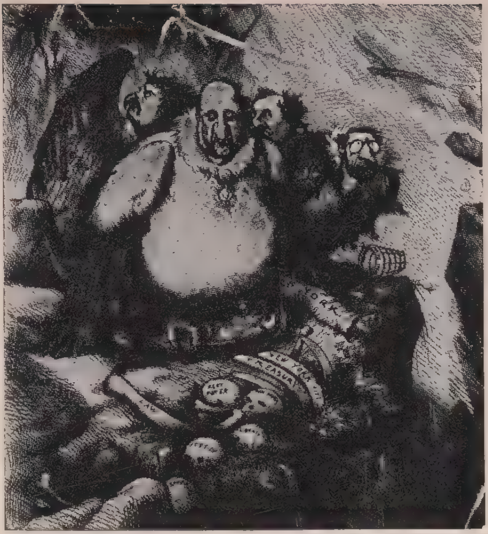
TAMBOURINE, *tam buh reen′,* a small percussion instrument consisting of a piece of parchment stretched over one face of a shallow wooden hoop. Small metal disks are fastened in pairs to the sides of the hoop. The player holds the instrument in one hand and shakes it to obtain a trill-like effect (a roll) from the jingling disks, or he holds the instrument in one hand and raps it against the palm or knuckles of the other. Rubbing the head of the instrument with the thumb produces a tremolo effect. Dancers who accompany their movements with the instrument frequently strike it against the elbow or knee. The tambourine is a favorite instrument of the peasants of Italy and Spain and is also used in other countries by performers of gypsy and folk dances. The timbrel referred to in the Old Testament was an instrument similar to the tambourine.

TAMERLANE, *tam′ur lane,* or **TIMUR**, *tih moor′* (1336-1405), a Mongol chieftain who made himself master of a great part of Asia, was born near Samarkand, which became the capital of his empire. A descendant of Genghis Khan, Tamerlane distinguished himself as a warrior and by 1369 was the ruler of all Turkistan. In times of peace he was a patron of science, art, and letters, but most of his life was spent in cruel wars of conquest. He subdued Persia and made expeditions against the peoples of southern Russia before turning east into India. He overran the country from the Indus River to the mouths of the Ganges (1398-99), killing thousands of prisoners and taking great quantities of booty. In 1402 he inflicted defeat on the Turks at the Battle of Angora and took the sultan prisoner. His realm then stretched from China to Asia Minor. Tamerlane was planning to invade China when he died of a fever. He was buried in Samarkand. See also GENGHIS KHAN.

TAMMANY, *tam'uh nih,* **HALL**, the political organization which formerly dominated the Democratic party of New York City, but is now practically identical with the Democratic organization of New York County (Borough of Manhattan). Tammany's power has always been concentrated on the island of Manhattan, and the decline of Tammany Hall is due to the decline of Manhattan relative to the other four boroughs of New York City; today Manhattan has less than 25 per cent of the total city population.

Tammany Hall is the political arm of the Society of Tammany, or Columbian Order. This society was organized on May 12, 1789, in order to give popular support to the Federal Government under President Washington, which had been established two weeks earlier. It was originally nonpartisan, but in 1800 it supported Thomas Jefferson's campaign for the Presidency. Soon thereafter two Tammany organizations developed, one social and the other political but both under common control. Tammany Hall waxed strong after the adoption of universal manhood suffrage in New York in 1822. From 1834 to 1932 it elected two thirds of the city's mayors, and it sometimes controlled the state government. Tammany gained popular support by passing out jobs, granting political favors, and giving charity to the needy. It welcomed and befriended the foreign immigrants.

Tammany became notorious because of its succession of unscrupulous political bosses, the most important of whom were William Marcy Tweed, Richard Croker, and Charles F. Murphy. The cartoons of Thomas Nast did much to break up the Tweed Ring, and the worst of the corruption was brought to an end in 1873 when Tweed was sent to prison. Tammany's long period of power ended in 1932 when Mayor James J. Walker was forced to resign because of charges of misconduct in office; its power was thereafter limited to county politics. In 1943 the Society of Tammany sold its headquarters building, and since that time the Society and the New York County Democratic Organization have had separate meeting places. See also NAST, THOMAS; NEW YORK CITY, *History;* TWEED, WILLIAM MARCY.



New York Public Library

TWEED AND HIS TAMMANY VULTURES wait for a storm of public criticism to blow over, in this cartoon by Thomas Nast.

TAM'PA, FLA., a picturesque, cosmopolitan city famous as a resort center, lies midway down the west coast of the state at the head of Tampa Bay, an arm of the Gulf of Mexico. The winter climate is warm. In sections of the city the Spanish influence is still strong. Industrially, Tampa is a world center for cigars, citrus-fruit canning, and phosphates. Other manufactures are beverages, containers, cement, chemicals, clothing, and meat and vegetable products. The city is a major distribution point for Florida's fruit, garden, and dairy products. It has a good harbor, and is served by two trunk-line railroads and two major airlines. The city's most popular annual events are the State Fair and the gay Gasparilla Carnival. The University of Tampa occupies the former Tampa Bay Hotel, a landmark renowned for its Moorish domes and minarets.

Early Spanish visitors to the region were Narvaez in 1528 and De Soto in 1539. Tampa was a small village in 1819 when the United States purchased Florida from Spain. The first railroad came in 1885, and the next year the Havana cigar industry moved to the city, bringing thousands of Cuban and Spanish workers; since then growth has been rapid.

THE GORGEOUS MALE SCARLET TANAGER shows its black wings and tail in flight. The female is below.

Tampa was the point of embarkation for American soldiers in the Spanish-American War. It is the seat of Hillsborough County. The population is about 124,000.

TAMPICO, *tam pe'koh*, MEXICO, in the state of Tamaulipas, is one of the leading seaports of the country, Veracruz being the other. Tampico is situated on the north bank of the Pánuco River about six miles from the Gulf of Mexico. Its location in one of the great oil-producing regions of the world has made it Mexico's chief port for the export of petroleum. The leading industries are those connected with oil refining and distribution. Until 1900 Tampico was a small city, unhealthful and unsanitary, with a second-rate port. Then the discovery of oil nearby caused a vigorous growth and development; large numbers of foreigners, especially Americans, settled in the city. The harbor and port facilities were greatly improved, drainage and sewer systems were established, modern utilities were installed, and many fine buildings were constructed. Tampico has excellent railway, motor-road, and airplane connections with other Mexican cities. The population is about 81,000.

TANAGER, *tan'uh jur,* a family of brilliantly colored songbirds of the Western Hemisphere. Most of them are found in Central and South America, but a few species reach the United States in summer. The *scarlet* tanager, which breeds in wooded country in the eastern and central United States and southeastern Canada, is about seven inches long. In the spring the adult male is very handsome. Wings and tail are black, and the rest of the plumage is a bright scarlet. The female is olive green and yellow, with dusky wings and tail. After the molt the male's bright red changes to olive green and yellow, but the wings and tail are always black. The scarlet tanager's song is like the robin's, though softer and sweeter. Its call note is a hoarse "chip churr." The *summer* tanager of the southern United States is a rosy-red bird without the black markings of the other species. The *western* tanager is yellow, with a red head and black wings, back, and tail. Tanagers feed mainly on insects and their larvae.

Scientific Names. Scarlet tanager, *Piranga olivacea;* summer tanager, *P. rubra;* western, *P. ludoviciana.*

TANCRED, *tang'kred* (1078?-1112), a Norman knight of Sicily, was a hero of the First Crusade. He joined the forces of his cousin Bohemund and distinguished himself in many battles against the Saracens. From 1100 to 1103, while Bohemund was a prisoner of the Turks, Tancred ruled Syria and Edessa in his place. He is represented in Tasso's poem *Jerusalem Delivered* as the flower of chivalry. See also CRUSADES, *The First Crusade.*

TANEY, *taw'nee,* ROGER BROOKE (1777-1864), a famous Chief Justice of the United States Supreme Court, who gave the decision in the Dred Scott Case. He was born in Calvert County, Md., and was graduated at Dickinson College in 1795. He was admitted to the bar in 1799. Taney served as a state legislator for one year, and in 1801 began law practice in Frederick. He was elected to the state senate in 1816 for a five-year term. Originally a Federalist, he became a Jackson Democrat after his party went out of existence in 1814. In 1827 he became attorney general of Maryland, and in 1831 President Jackson appointed him Attorney General of the United States. Two years later, given a recess appointment as Secretary of the Treasury, he removed the government deposits from the Bank of the United States, as President Jackson wished. The Senate retaliated by refusing to confirm his appointment. In 1836 Taney succeeded John Marshall as Chief Justice of the Supreme Court and served in this position until his death in 1864.

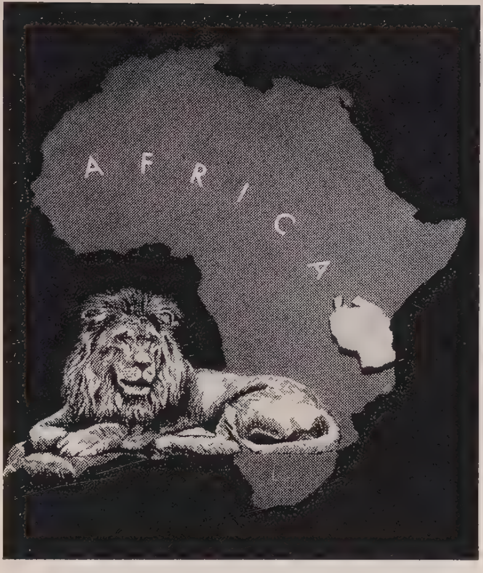
As a jurist he displayed marked ability and learning. He stood firmly for state sovereignty. Many of his decisions were severely criticized, especially that in the Dred Scott Case and the one denying the right of the President to suspend the writ of habeas corpus. See also DRED SCOTT DECISION; MISSOURI COMPROMISE.

TANGANYIKA, *tang gan ye'kuh,* LAKE, the longest fresh-water lake in the world, is situated in east-central Africa a few degrees south of the equator, between Tanganyika Territory and Belgian Congo, and about 175 miles southwest of Lake Victoria. The lake is about 450 miles long and from 30 to 45 miles wide; its area is estimated at 12,700 square miles. With a depth of at least 4,700 feet, it is second only to Lake Baikal as the deepest fresh-water lake in the world; its altitude is about 2,600 feet, and its floor more than 2,000 feet below sea level. The lake has numerous floating islands covered with palms. The waters teem with fish and other aquatic life, while the shallows abound in crocodiles and hippopotamuses.

Lake Tanganyika was discovered by Sir Richard Burton and John Speke in 1858 and was explored by Livingstone, Stanley, and others in 1871. Small steamships now ply the waters of the lake. Kigoma on the eastern shore is connected by rail with Dar es Salaam on the Indian Ocean; on the western shore Albertville has rail connections with the Atlantic.

TANGANYIKA TERRITORY, a United Nations trust territory, is located in east Africa just south of the equator. It is bounded on the east by the Indian Ocean; on the south and southwest by Portugal's Mozambique, by Lake Nyasa, and by Nyasaland Protectorate and Northern Rhodesia (both British); on the west by Lake Tanganyika and Ruanda-Urundi, a Belgian trust territory; and on the north by the British protectorates Uganda and Kenya and by Lake Victoria. The adjacent islands of Zanzibar and Pemba in the Indian Ocean form a separate British protectorate. The area of Tanganyika is about 360,000 square miles.

The climate is tropical, except in the highlands of the interior. One semitemperate section is in the northeast near Mount Kilimanjaro (19,317 feet), the highest peak in Africa. The Rufiji River is the only navigable stream. Many small streams flow into Lakes Tanganyika and Victoria, which drain into the Congo and Nile respectively. The coastal plains and river valleys have tropical forests, but much of the interior plateau is grassland. Tanganyika abounds in nearly all the big game of Africa; much of it is infested also with the terrible tsetse fly, which spreads sleeping sickness among men and beasts. The population is over 7,400,000, including about 16,000 Europeans and 60,000 Asiatics, mostly Indians. The natives, who are divided into more than one hundred tribes, are predominantly Bantus. Farming and stock raising are the chief occupations; the leading crops are cotton, coffee, corn, sugar cane, copra, tea, tobacco, and peanuts. Tanganyika leads the world in the production of sisal, which is also its principal export. The mineral products include gold, diamonds, mica, and tin ore. The capital is the seaport of Dar es Salaam, which is connected by rail with Lakes Tanganyika and Victoria, both of which have steamship service.



A SPORTSMAN'S PARADISE is Tanganyika, famed for its rich and varied wild-animal life. The territory is about the size of Ontario.

In 1884 Germany began the colonization of the territory, which was called German East Africa. It was occupied by Allied troops during World War I. After the war it was renamed Tanganyika and made a League of Nations mandate under British administration, except for the districts of Ruanda and Urundi, which were turned over to Belgium. In 1946 Tanganyika became a United Nations trust territory.

TANGERINE, *tan jeh reen′,* a citrus fruit with a thin, reddish-orange skin which is easily removed from the delicious, segmented pulp. Because it is easy to peel, the tangerine is also called the kid-glove orange. It is not as large as the orange, however, and in shape it is more flattened. Although tangerines are easily bruised and quick to spoil, they are shipped in quantity from Florida orchards to northern markets, where they enjoy wide popularity. Tangerines are a good source of calcium and vitamin C. The tangerine, which originally came from Asia, is raised also in North Africa and tropical United States. The name *mandarin* is often applied to a yellowish fruit of the same variety as the tangerine. See also ORANGE.

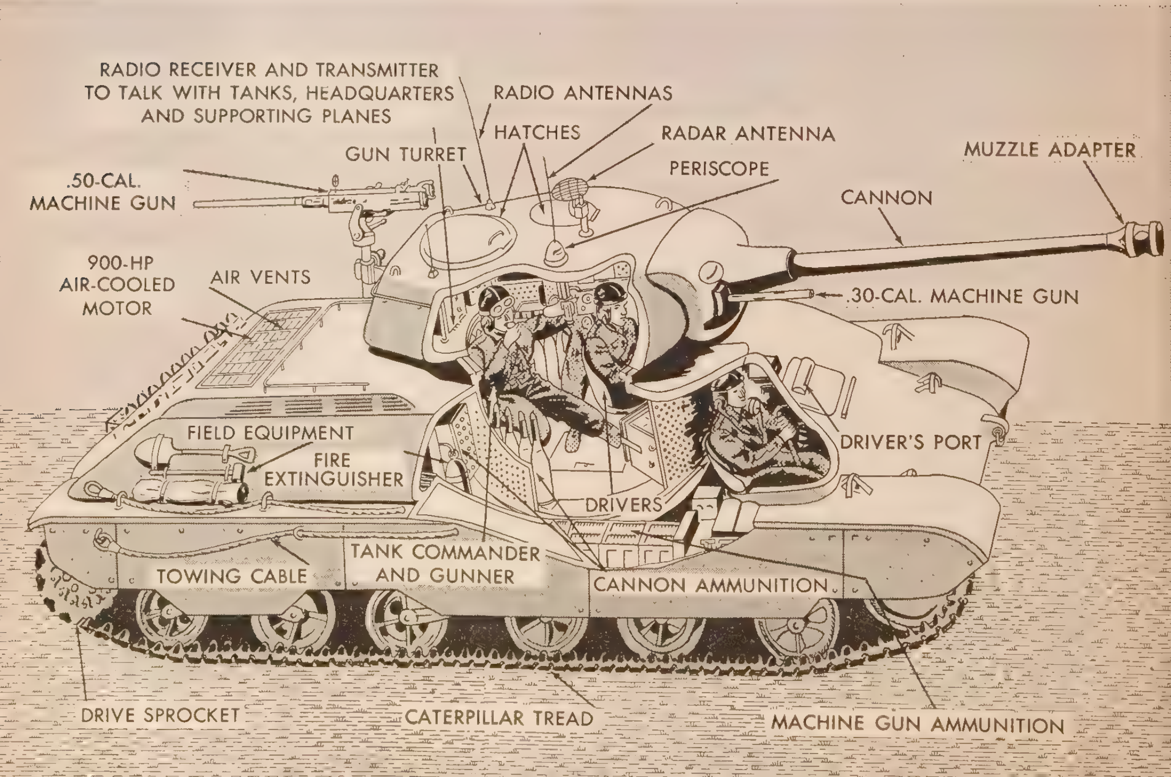
TANGIER, *tan jeer′,* an international zone on the northwest coast of Africa at the western entrance to the Strait of Gibraltar. This zone of 225 square miles, completely surrounded on the land side by Spanish Morocco, is governed by an international committee representing nine countries, namely the United States, France, Great Britain, the Soviet Union, Belgium, the Netherlands, Portugal, Spain, and Italy. The sultan of Morocco, who holds the nominal sovereignty, controls native affairs. The city of Tangier, rising like an amphitheater from the water front into a semicircle of hills, is an important seaport. The population is about 150,000, including about 30,000 Europeans and 7,000 native Jews; most of the rest are Moslem Arabs and Berbers. Farming and fishing are carried on, but duties on imported goods are the chief source of income to the zone. Shortly after 1900, while the rest of Morocco was being divided into French and Spanish zones, plans were made to internationalize Tangier because of its strategic location; not until 1923, however, were the European powers able to agree on an international statute of control, which became effective two years later. During World War II, Spain occupied Tangier, but the international administration was restored in October, 1945, after the end of the war. See also MOROCCO.

TANK, MILITARY, an armored vehicle constructed on the basic plan of the caterpillar tractor and driven by gasoline or diesel engine. Encased in armor plate ranging from one to more than four inches in thickness, tanks can be damaged only by high explosives or by special antitank shells. They are used chiefly for aggressive action, leading infantry attacks and breaking enemy lines and communications. Light tanks, which are faster and less heavily armed and armored than medium and heavy tanks, carry out scouting missions and are sometimes dropped by parachute with airborne assaults. Specialized forms of the tank include the *tank destroyer,* a tank chassis supporting a heavy gun; the *flame-thrower tank*; and the *amphibious tank,* which can ford rivers and make beachhead landings.

Tanks move forward on endless tracks at speeds ranging up to forty miles an hour. Like tractors, they can move through mud and brush, cross ditches, and climb steep slopes. Atop each tank is a power-operated gun turret, which can swing in any direction. Tank guns, which are automatically stabilized, have calibers ranging from 76-mm. and less to 122-mm. and more. Heavy and light machine guns add to the tank's fire power. Large tanks carry as many as eight crew men, including drivers and gunners. Today, a tank company is a part of every American infantry regiment.

The tanks of World War I, introduced by the British in the Battle of the Somme in 1916, were extremely slow and clumsy as compared with modern tanks. By the outbreak of World War II, however, the Germans had developed fast-moving tanks which

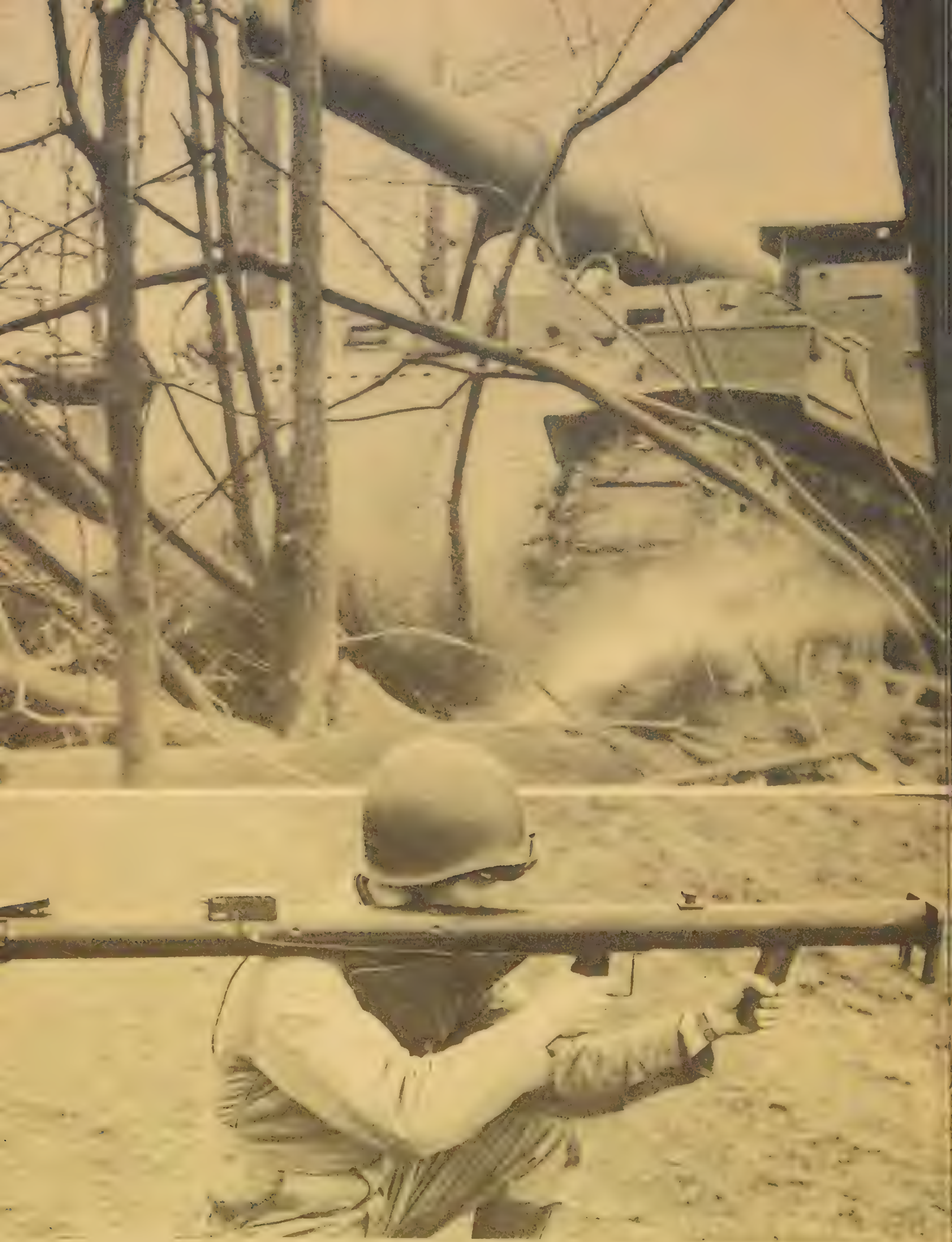
WITH FIVE-INCH ARMOR IN FRONT and on the turret and three-inch armor on the sides and at the rear, a powerful, well-armed, forty-five-ton tank rumbles into action. Less than nine feet high, it offers a low-lying target, difficult for enemy gunners to hit.



TANKS IN OFFENSIVE WARFARE

(1) The Water Buffalo, powerful amphibious tank with heavy armor, a cannon, and two 50-caliber machine guns. In water it is used for freeing boats caught on reefs. (2) A tank battalion in formation ready to attack. (3) A tank rolls directly onto an island beach from the ramp of a flat-bottomed Landing Ship, Tank (LST). (4) The General Pershing, or M-26, a United States Army tank developed during World War II. (5) A realistic picture of a sham battle with a tank firing actual ammunition. United States trainees faced real hazards in these maneuvers.

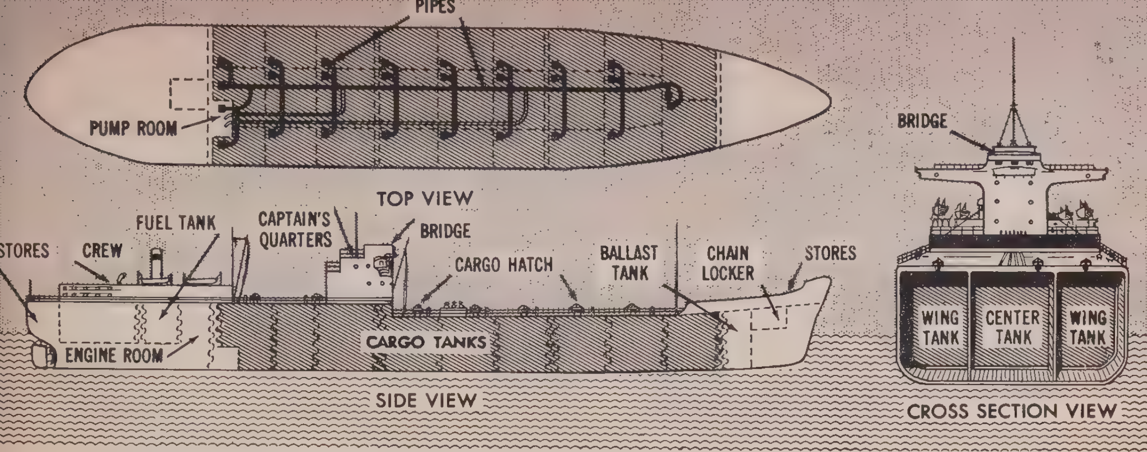
U.S. Navy; U.S. Army Signal Corps; U.S. Coast Guard; Acme; U.S. Army



U.S. Signal Corps

DEFENSE AGAINST THE TANK

Above: The United States Army's M-12, said to be a match for any tank. Officially described as a gun, motor carriage, it is a 155-mm. gun mounted on an M-3 tank chassis. It has the speed of a medium tank, thus being highly mobile, and throws an 85-pound projectile more than 10 miles. At that range it can knock out a tank or sink a heavy cruiser. The M-12 is equally destructive against enemy artillery. Rough terrain, dense thicket, or trees of the size shown are no barrier to this weapon. Below: The antitank rocket gun commonly known as the bazooka. It has the power of a 75-mm. cannon; two men and a bazooka can knock out a tank with one good hit.



Popular Mechanics Magazine

CARGO MUST BE SHIFTED FROM TANK TO TANK during a voyage, to compensate for the lightening of the ship's fuel and water supply and thereby keep the vessel on an even keel.

were tremendously effective in the Nazis' lightning assaults on their neighbors. Tank duels were very common in the North African campaign, and in the final Allied drive against Germany tank forces led repeated breakthroughs. In the Pacific, specialized tanks were developed for invasions and jungle fighting.

American tanks used in World War II included the Grant, Sherman, and Pershing, which ranged in weight from 28 to 43 tons. The German Tiger weighed 62 tons; but extremely heavy tanks of this type are looked upon by some military experts as too massive for effective use, despite their great fire power. While the Soviet Union continued to turn out tanks like the 57-ton Stalin III, the United States after World War II emphasized medium tanks like the Patton and speedy light tanks, equipped with very powerful air-cooled engines. American and Russian tanks clashed in the United Nations action against Communist aggression in Korea, which broke out in 1950.

After World War II constant research and experiment resulted in improved fire control and simplified driving control for tanks. Tank treads were redesigned for greater efficiency, and both fire power and engine power were increased. The bazooka, in various forms and sizes, became one of the most effective of antitank weapons. Tanks may also be halted by tank destroyers and other types of artillery, by bombs, and by tank traps and barriers. See also Army; Artillery; Bazooka.

TANKER, a ship built to carry oil and other liquids. Engines, living quarters, and wheelhouse are usually located in the stern. The remainder of the vessel is a huge tank, partitioned off into sections. Rubber hoses and pipes are used for loading and unloading such cargoes as petroleum and other oils, gasoline, and molasses. Large tankers, exceeding 600 feet in length, may have capacities of as much as ten million gallons. Speeds range up to about twenty knots. Because the cargoes they carry are both difficult and dangerous to handle, tankers must be manned by skilled, experienced crews. First developed late in the nineteenth century, these specialized vessels now hold a position of major economic and strategic importance in world commerce. See also Ship.

TAN′NIN, or **TANNIC ACID**, any one of a class of substances of vegetable origin that are used in tanning skins to make leather, in the manufacture of writing inks and of gallic and pyrogallic acids, and as mordants to fix colors in dyeing and printing textiles. Preparations containing *gallotannic* acid, obtained from the powdered gallnuts of oaks, have been used for internal medication and externally in the treatment of eruptions and burns and as astringents and styptics to stop bleeding. These preparations are no longer included in the list of official remedies in the *Pharmacopeia of the United States.*

All tannins are astringent, solid materials that are soluble in water and in alcohol. They react with ferric salt solutions to give dark blue or greenish-black precipitates, and they also precipitate gelatin solutions. Though tannins occur in tea leaves, coffee beans, and many kinds of bud and unripe fruits, the important sources include oak galls; sumac leaves; myrobalans, prune-like dried fruits of certain Chinese and Indian trees; divi-divi, dried seed pods of a tropical American tree; the bark of some varieties of oak, hemlock, pine, birch, mangrove, eucalyptus, and acacia (the wattle of Australia); and the wood of oak, chestnut, and the quebracho of South America. *Syntans* are synthetic compounds with some of the properties of tannins useful in the tanning industry. See also Galls; Ink; Leather; Mordants.

TANNING. See Leather.

TANSY, *tan′zih*, a genus of plants of the composite group bearing fernlike leaves and flat clusters of small yellow flowers. The *common* tansy, native to Europe and introduced into the United States, is a perennial growing about three feet tall. It was once widely cultivated for its bitter, aromatic leaves, which were used as culinary and medicinal herbs. In England the tansy was particularly associated with Easter, when tansy puddings and tansy cakes were eaten in memory of the bitter herbs eaten at Passover.

TANTALUM, *tan'tuh lum,* is a bright, silvery-white, metallic element. It is strong and can be hammered into very thin sheets and drawn out into very fine wires. Tantalum is a heavy metal (specific gravity, 16.6) with a very high melting point (2996°C.). Its symbol is Ta, atomic weight 180.88, and atomic number 73. Tantalum does not tarnish in air and is highly resistant to the action of most acids.

Tantalum was first used for making the filaments for electric-light bulbs, but has been largely replaced for this purpose by tungsten. Tantalum is used to remove gases from radio and radar tubes; as a catalyst in the manufacture of synthetic rubber; and in making optical glass for aerial camera lenses, corrosion-resistant chemical apparatus, dental and surgical instruments, and spinnerets employed in the manufacture of rayon. Tantalum is employed in some electric-current rectifiers because it permits an alternating current to pass through it in one direction only. Tantalum forms a carbide that has a very high melting point (3875°C.) and a hardness approaching that of the diamond. Tantalum carbide is used as an abrasive and as a cutting material.

Tantalum was discovered in 1802 by Ekeberg. Although it is more abundant than lead in the earth's crust, it is not produced in large quantities because it is difficult to extract from its ores. It occurs principally in the mineral tantalite, $Fe(TaO_3)_2$, which is produced principally in the Belgian Congo. The mineral is also produced in Australia; in the Northwest Territories, Canada; in the Union of South Africa; and in the United States, chiefly in the Black Hills region in South Dakota.

The Metropolitan Museum of Art

THIS DETAIL FROM "HERCULES," a tapestry produced in France around 1500, provides an example of the *millefleurs* style.

TANTALUS, *tan'tuh lus,* a legendary Greek king, was the son of Zeus (Jupiter). Although he had been admitted as a friend to the table of the gods, he incurred their wrath by offering them his murdered son, Pelops, as food. For this crime he was sent to the lower world, where he was plunged chin-deep into a pool of water. He was plagued by an unquenchable thirst, but when he tried to drink, the waters receded. His raging hunger was increased by tempting fruit which hung above him and which withdrew as he reached for it. A huge rock suspended over him forever threatened to fall and crush him. The word *tantalize* is derived from the legends of these punishments.

TAOISM, *tou'iz'm,* a Chinese philosophy which developed into a popular religion. It is attributed to Lao-tzu, who was born about 604 B.C. It teaches that man must seek harmony with the Tao, the benevolent cosmic force behind all life and energy; it demands that the individual must strive to escape from self and must not resist aggression. The Taoist ideal, a humble, innocent, frugal, free agrarian existence, differs from that taught by Confucianism, which emphasizes education, morals, and political control. Taoism gradually degenerated into the practice of magic, alchemy, and divination. In the second century A.D., Chang Tao Ling organized the philosophy into a religious cult, which has become popular among the common people. Taoism has a host of gods and spirits and a horde of priestly magicians, who perform awesome physical feats and claim supernatural powers. In its religious practices it owes much to Buddhism. See also CHINA, *Religion.*

TAP'ESTRY, a hand-woven ornamental fabric in the simplest form of over-and-under weave. The undyed warp threads, of strong wool, linen, or cotton, are stretched on a vertical (high-warp) or a horizontal (low-warp) loom, and the colored weft threads are passed over and under the warps to form the pattern. The weaver works on the wrong side of the fabric and watches the development of the pattern in a mirror. With a high-warp loom he lifts each warp thread by hand in order to pass the filling thread underneath. A low-warp loom has two foot pedals that lift alternate rows of warp

The Metropolitan Museum of Art

"THESEUS AND THE MINOTAUR" reveals the influence of modern art on work produced since the revival of tapestry-making in recent times.

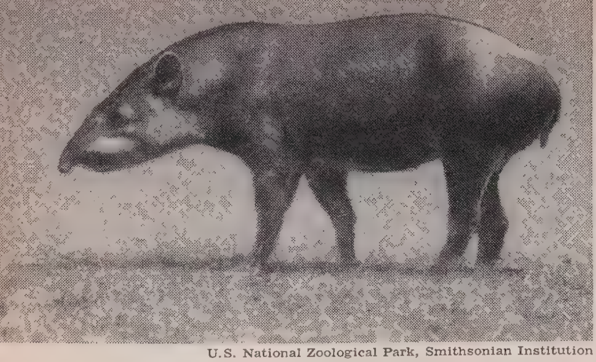
threads to form a shed through which the bobbins carrying the weft are passed. The warp threads, which are horizontal in the finished work, are completely covered by the weft. Tapestry weaving differs from ordinary weaving in that the weft threads are not passed all the way from one side of the fabric to the other. The weaver may use many colors in a single row.

History of the Art. Examples of Egyptian tapestry weaving dating from the fifteenth century B.C. have been found in ancient tombs, and it is known that the Greeks and the Romans used this process to create patterns in woven fabrics. The art flourished in the Orient and was probably brought back to western Europe by the Crusaders. The great period of tapestry making came with the development of Gothic art in northern Europe. Gothic castles, with their cold, high-ceilinged rooms, needed the color and the warmth of wall hangings. Tapestries were used to divide large rooms into smaller units, to curtain windows, and to decorate the walls. They could be easily carried from one place to another, and could be used for warmth and for decoration in temporary lodgings or in the tents of military leaders in the field.

Flanders was the center of medieval tapestry making, and for a long time Arras was the principal city of the industry. A tapestry designed as a wall hanging came to be called an *arras*. Tapestries were woven to order for churches and royal apartments, and the designs were created by some of the finest artists of the times. The subjects were taken from ancient or contemporary history, from mythology, or from Bible stories. There were also hunting scenes and pictures of country life. Some of the finest early tapestries in the United States are the *Burgundian Sacraments*, now in the Metropolitan Museum of Art. The series called *The Lady of the Unicorn*, a treasure of the Cluny Museum in Paris, was probably woven at Aubusson in France early in the sixteenth century. These tapestries have a fanciful background of flowers, fruit, and little animals in the style called *millefleurs*.

When Pope Leo X requested the painter Raphael to design a series of tapestries for the Sistine Chapel of the Vatican, the cartoons were sent to Brussels to be woven. These *Acts of the Apostles* tapestries were frequently copied, and tapestry design began to be thought of as a kind of painting. The Gobelin factory in Paris, which became a state industry in 1662, turned out many reproductions of paintings as well as historical scenes celebrating the greatness of the French kings.

Flemish weavers took their art to England, and in 1619 an English industry was established at Mortlake, near London, which flourished for nearly a century. But the art of tapestry making began to decline in the eighteenth century. Wallpaper offered competition; rooms were smaller and needed lighter, thinner fabrics for their decoration. Power looms, with mechanical devices for weaving patterns, were devised, and eventually tapestry weaving dwindled to a minor art form. The Gobelin and the Beauvais state factories in France still produce beau-



U.S. National Zoological Park, Smithsonian Institution

THE HOMELY TAPIR sometimes walks along the bed of a stream with only its nose above water.

tiful examples of tapestry work in modern designs, but the cost of such hand work is almost prohibitive. Decorative fabrics created by needlework are not tapestries. The famous Bayeux Tapestry is a piece of embroidery (see Bayeux Tapestry).

TAPE′WORM, a parasitic worm inhabiting the intestine of man and of many backboned animals. Numerous species of tapeworms, varying in length from a few inches to ten yards or more, have been identified. Among the best known are the beef and pork tapeworms. The body of these worms consists of a head and many flat segments arranged in chainlike fashion. As the worm grows, more segments are added behind the head so that the oldest and largest segments are located at the end of the body. The head bears suckers and, in the pork tapeworm, hooks for grasping the intestinal lining.

Human beings become infected with tapeworms by eating raw or poorly cooked pork or beef containing the larval worms. When the larva reaches the host's intestine, it attaches itself and begins to grow. Each of the worm's segments contains male and female reproductive organs, which produce thousands of shelled eggs. As a segment ripens and becomes filled with eggs, it detaches from the tapeworm and is swept out of the host's body with the feces. If the eggs are eaten later by a pig or by cattle, they hatch and migrate through the animal's blood stream into the muscles. The life cycle of the worm is completed when the larvae-infested flesh of the animal is eaten by another person.

Tapeworms not only deprive their victims of food but also release poisonous substances into the body. Infected persons often have a ravenous appetite, lose weight, suffer abdominal distress, and are generally restless and weak. Treatment includes the administration of drugs, such as carbon tetrachloride and hexylresorcinol, which causes the head of the worm to lose its hold in the intestine. But since these drugs may be poisonous, they should be taken only under the supervision of a physician. Tapeworm infections may be avoided by thoroughly cooking all meat.

Scientific Names. Pork tapeworm, *Taenia solium;* beef tapeworm, *T. saginata.*

TAPIOCA, *tap ih oh′kuh,* a starch food prepared by grinding to a pulp the long, thick roots of the tropical cassava plant, straining out the fibers, and quickly drying the starch which remains. Tapioca is used chiefly in the preparation of a nutritious pudding, which has about 150 calories to a serving, and to thicken soups. When boiled, the dried "pearls" of tapioca swell and form a jelly-like mass. See also Cassava.

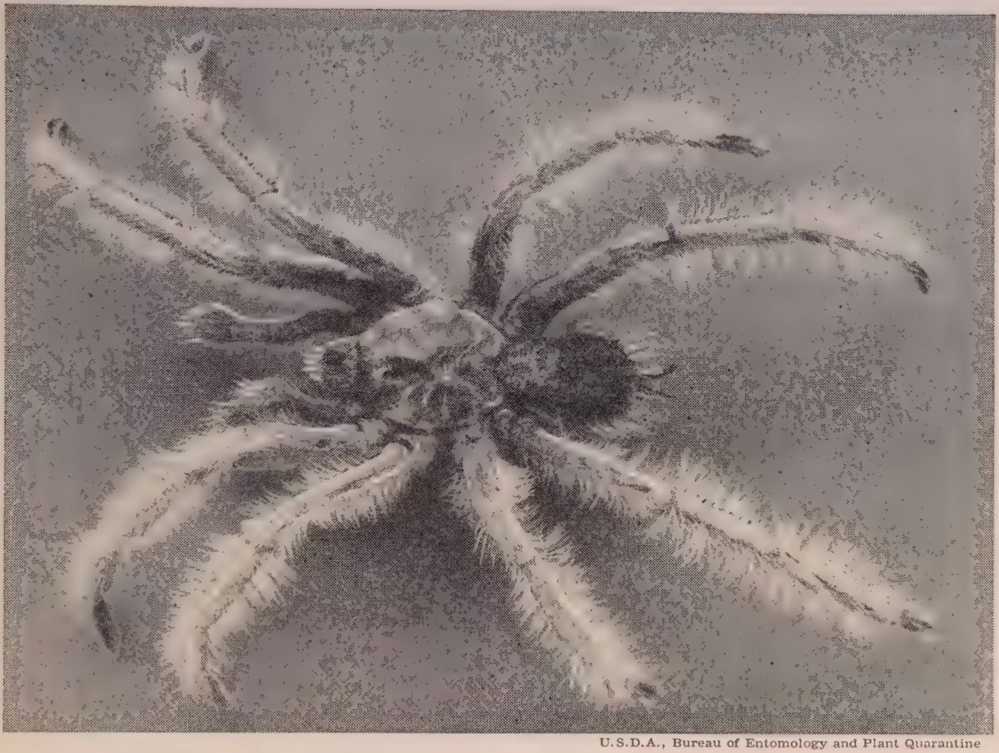
TAPIR, *ta′p′r,* an odd-looking animal most nearly related to the rhinoceros and the horse. Five species of tapirs are found — one in the jungles of the Malay Peninsula and four in South America. In general shape tapirs resemble pigs, but they have longer legs, short, round ears, and a short, flexible, trunklike snout. The Malayan species reaches a length of eight feet, and its coarse-haired coat is blackish brown with white sides, back, and rump. The American species, only six feet long, are solid black or brown. Shy and defenseless, tapirs are entirely harmless. They feed on vegetation and are excellent swimmers and divers. The natives eat their flesh and use their hides as leather.

Scientific Name. Malay tapir, *Tapirus indicus.*

TAR, *tahr,* a dark-colored, oily liquid, thick and viscous, obtained by destructive distillation of such organic substances as wood, coal, lignite, peat, shale, and bone (see Distillation). It flows very slowly unless its viscosity is diminished by heating, but it is more fluid than *pitch,* which is left when the lighter oils are removed from tar by evaporation or distillation. *Coal* tar owes its great industrial importance to its many direct uses and to the hundreds of products made from it (see Coal Tar).

Wood tar is obtained in addition to charcoal, acetic acid, and wood alcohol when wood is heated away from air in closed retorts. Its composition is more complex than that of coal tar and is different for different kinds of wood. Softwood tars are used in the compounding of rubber and for preserving wood and rope. Pine tar is used for roofing and as an ingredient of cough medicine and antiseptic soaps and ointments. Tarred hemp fibers (oakum) have long been used for calking decks and sides of wooden ships, and tar or pitch are used to cover the calked seams and make them watertight (see Calking).

On fractional distillation, wood tars yield, directly or after further refining, such products as creosote, naphtha, phenols, resins, oils for solvents or for separation of minerals by flotation, and other chemicals. The residual pitch is used in varnishes, for waterproofing, insulating, and lubricating purposes, as a preservative, as a binder for coal dust in making briquette fuel, and in the manufacture of building paper.



U.S.D.A., Bureau of Entomology and Plant Quarantine

THE BITE OF THIS TARANTULA from Honduras is extremely painful to the victim.

TARANTULA, *tuh ran'tyu luh,* any of several kinds of large, hairy spiders inhabiting the warmer parts of the earth. The true tarantula of Europe derives its name from the Italian city of Taranto. Although it is actually harmless to man, during the Middle Ages its bite was believed to cause *tarantism,* a disease similar to St. Vitus' dance. The tarantulas found in the southwestern United States and in Central and South America can inflict painful bites, but on the whole are not deadly. Most species feed on insects, swiftly attacking their prey rather than snaring it in webs, as spiders usually do. A few of the larger Central and South American tarantulas, which may have an over-all spread of seven inches or more, catch and eat birds. See also SPIDER.

Scientific Name. European tarantula, *Lycosa tarantula.*

TARAWA, *tuh rah'wuh.* See GILBERT ISLANDS.

TARE, *tehr.* See VETCH.

TARIFF, in the common meaning of the term, refers to the customs duties assessed on imported or exported goods, but in its broadest application it means any rate or charge. The tariff on railroads, for example, refers to the freight and tariff rates charged. The practice of levying customs duties on imports and exports was common among the nations of ancient times. Egypt, Assyria, Babylonia, all had systems of tariff. Later the same custom was practiced by the Greeks and Romans, from whom it passed to medieval kingdoms and to practically all countries of the modern world.

Purposes of a Tariff. A tariff is levied for one or more of the following purposes: to obtain revenue for the government, to protect home industries, or to retaliate for unjust commercial treatment by some other nation (commercial warfare). A tariff for revenue only is called a *revenue* tariff, and a nation levying tariff for revenue only is called a *free-trade* nation. A revenue tariff is imposed on goods that are not produced in the country of entry, thus granting no protection. England, long a free-trade nation, was obliged to adopt protection after World War I.

A tariff designed to protect home industries is called a *protective* tariff. It affords protection to the industry upon whose products it is laid by placing a tariff, in addition to that for revenue, equal to the difference between the cost of manufacture of the article in a foreign country and the cost of manufacture of the same article in the importing country. If steel rails, for instance, could be manufactured in England and shipped to the United States at a cost which would allow them to be sold for one dollar less a ton than they could profitably be made in the United States, American manufacturers would be unable to compete with British manufacturers. To protect American manufacturers, Congress might place a special tariff of a dollar a ton on the imported rails, which could not then be sold for less than the domestic product after payment of the duties.

A tariff for retaliation is seldom resorted to at the present time; however, many commercial treaties contain *reciprocity* agreements, whereby each nation agrees to admit certain articles into its ports at a lower tariff rate than the regular schedule requires, provided the other nation will admit certain articles into its ports on a similar basis. Fair reciprocity agreements are usually advantageous to both countries.

In general, a revenue tariff is best for nations that have to import most of their raw material and a large proportion of their foodstuffs. It was mainly because of these conditions that England became a free-trade nation in the nineteenth century. On the other hand, protection is usually considered the best policy for a new nation having abundant resources and desirous of building up extensive manufacturing interests. This policy is also used by older nations desiring to develop industries that might be needed in time of war. Before World War I all the leading European nations except Great Britain had protective tariffs, and protection is still the policy in many countries.

In Great Britain. Britain abandoned free trade in 1931 as a result of a depression. The basic tariff law, the Import Duties Act of 1932, imposed moderate rates on all imports except those from the empire, with most basic foods specifically excluded. Trade agreements with the Dominions were drawn up at the Ottawa Conference of 1932, which was attended by representatives of Great Britain and the empire; these agreements generally gave preference to empire products for importation into Great Britain, excluding them from the tariff schedules. Later, trade treaties were negotiated with countries important as sources of raw materials and food, such as the Scandinavian nations, Argentina, and the United States. Under the Labor government, after World War II, no appreciable change in British tariff policies was made.

In the United States. The United States has favored tariff regulations throughout its history, and free trade has never been an issue. Although Republicans have generally favored high rates and Democrats low rates, party differences have not always been clearly defined. Basically, American tariff policy has been influenced by Alexander Hamilton's conviction that the United States could succeed industrially if it adopted protective duties, permitted free importation of raw materials, and encouraged invention through a patent system. Hamilton considered protection to be a temporary feature of the nation's economic life and never advocated the use of prohibitory tariffs.

The first American tariff legislation, enacted in 1789, and the second, enacted in 1790, had the raising of revenue as their primary purpose. Rates were increased during the next twenty-five years. In 1815 President James Madison advocated a tariff as protection for the nation's new manufacturing interests, and the tariff law of 1816 was frankly protectionist. In the debates over the tariff bill of 1824 Henry Clay voiced the principles of adequate protection for American industry, and the act as passed imposed a special rate of four cents a pound on imported wool, in addition to a regular tariff rate. This special tariff was intended to block importation and therefore established a new principle in American tariffs.

The tariff act of 1828, called by its opponents the *tariff of abominations,* provided high protective rates on many items. The protests of Southerners fearful for their European markets in cotton were joined by those of Northerners like Webster who were seeking to safeguard New England's ocean-carrying trade. There was bitter controversy over the merits of protection, as well as concern over the constitutionality of the economic barriers involved. As a result of Southern protests, including the act of nullification passed by South Carolina (see NULLIFICATION), the tariff act of 1828 was superseded by the compromise act of 1832, which reduced rates to the level of 1824. The Walker Tariff Act of 1846, intended for revenue rather than protection, was almost free trade in character. Further reduction in rates occurred with the new tariff of 1857.

With the coming of the Republicans into power (1860), the policy of decreasing tariff duties was abandoned. The Republican act of 1861 (the Morrill tariff) was moderate; but the law of 1864, which remained basic until 1883, was protectionist, providing for the high average rate of 47 per cent. The law of 1883, enacted because of the growing discontent with the high duties, reduced the rate by only 5 per cent, for protectionists among the Republican lawmakers remained powerful despite the widespread protest and a treasury surplus. The main importance of the McKinley Act of 1890, which added many agricultural products to the list, was the acknowledgment that protection was not a temporary policy for the protection of infant industries but a permanent feature of America's economic life.

In the Wilson-Gorman Act of 1894, following a Democratic victory, rates were generally reduced, but special interests prevented downward revisions for many items. Wool was placed on the free list in an attempt to establish the principle that raw materials should be tariff-free. But the Republicans were victorious in 1896; and under the Dingley Act of 1897 wool was returned to the tariff list, and rates were greatly increased. In 1909, despite strong popular opposition to existing high tariffs, Congress passed the Payne-Aldrich Act, which maintained high rates. This act provided for either maximum or minimum tariff rates for foreign countries, depending upon the concession made in return. It further established the Republican principle that tariff rates should be high enough to equal the difference between costs of manufacturing in the United States and costs in foreign lands and also to assure the American manufacturer a reasonable profit.

In 1913 victorious Democrats passed the Underwood-Simmons Act, setting forth the principle of a competitive tariff which would permit American manufacturers to compete with European manufacturers *without* assuring the former of a reasonable profit. Rates were reduced generally, and the Democratic policy of moderate protection was established. But World War I prevented the tariff from operating freely; and with the return of the Republicans to power in 1920, the protectionists again had their way. They passed the Fordney-McCumber Act of 1922, which provided for the utmost in protection and canceled the principle of moderation, and the Hawley-Smoot Act of 1930, which established high rates on all products, including farm produce and numerous items not even made or grown in the United States. The latter measure caused violent protest from American economists and even from foreign nations.

Although many economists insisted that the Hawley-Smoot tariff played a major role in the worldwide depression of the 1930's, the Republican party in its platform of 1932 ignored all criticism. The Democratic victors in the election of that year favored reciprocal trade agreements; and in 1934 the Reciprocal Trade Agreement program, enacted as an amendment to the Hawley-Smoot Act, became law. This act gave the President the authority, renewable every three years, to reduce tariff rates by a maximum of 50 per cent, provided that the country concerned made favorable concessions to the United States. As of January 1, 1945, a further reduction of 25 per cent was authorized for many items. Twenty-eight countries completed reciprocal trade agreements with the United States in the next twelve years, and other nations were later added. In 1947 America joined with twenty-two other nations in negotiating the General Agreement on Tariffs and Trade, a major step in the direction of freer world trade achieved through reciprocity and economic co-operation. The United States maintains a policy of negotiating trade agreements with any nation willing to make like concessions. President Truman called the agreements the center cord to international economic co-operation under the United Nations.

Related Articles. For additional information, consult the following titles:

Customs Duties	Protection
Economics	Reciprocity
Free Trade	Tax

TAR′KINGTON, [NEWTON] BOOTH (1869-1946), American author, was born in Indianapolis, Ind., and lived there all his life. Educated mainly at Purdue and Princeton universities, he intended at first to become an artist, but he found that his real talent lay in writing. *The Gentleman from Indiana* (1899) was his first popular success. The following year he published the romantic story *Monsieur Beaucaire,* which was later successfully presented as a stage play and as a motion picture. Most of Tarkington's material for his many novels and stories was drawn from his own Middle West background. His amusing narratives about adolescents — *Penrod* (1914), *Penrod and Sam* (1916), and *Seventeen* (1916) — were widely read. Two of his novels, *The Magnificent Ambersons* (1918) and *Alice Adams* (1921), were awarded the Pulitzer prize. Tarkington also wrote a number of plays. The most successful included *The Man from Home* (written with Harry Leon Wilson, 1908), *Mr. Antonio* (1916), and *Clarence* (1919).

TARO, *tah′roh,* a tropical food plant, also known as *edds* or *dasheen,* is a staple foodstuff of millions of Orientals and Pacific islanders. Its large potato-like tuber, which contains a quantity of easily digested starch, is boiled, baked, or otherwise prepared to destroy the bitterness of the juice. *Poi,* made of taro ground to a paste and then fermented, is a traditional Hawaiian dish. The large shield-shaped leaves of the taro are also cooked and eaten. Many different varieties are native to Malaya, Polynesia, and southeastern Asia; and taro plants have been introduced in the Mediterranean area and in the southern United States. One well-known variety is the ornamental elephant's ear. Taro requires rich, moist soil and a long growing season. Like the calla lily and the jack-in-the-pulpit, it belongs to the arum family.

TAR′PON, a game fish inhabiting the Atlantic from Nova Scotia to Brazil. Like the other members of the herring family, the tarpon is blue above and silvery white beneath. It usually averages between four and six feet long and weighs from 75 to 150 pounds, but eight-foot specimens, weighing 300 pounds, have sometimes been encountered. Tarpon are excellent game fish, leaping spectacularly above the water when hooked. They are taken on heavy tackle by trolling with live bait or artificial lures. In Central and South America they are regarded as food fish.

Scientific Name. *Tarpon atlanticus.*

U.S. Fish and Wildlife Service

THE POWERFUL TARPON, a salt-water fish, can move into fresh-water lagoons and survive.

TARQUINIUS, *tahr kwin'ih us,* LUCIUS, the name of two legendary kings of early Rome. According to tradition, **Tarquinius Priscus**, or Tarquin the First, was the fifth king of the city and ruled from about 616 to 579 B.C. He may have come to Rome from the Etruscan city Tarquinii. The first Tarquin is said to have built the Cloaca Maxima, the great sewer that drained the Roman marsh, the Temple of Jupiter on the Capitoline Hill, and the Circus Maximus.

Tarquinius Superbus, or Tarquin the Proud, said to be the son of the first Tarquin, was the last of the seven Roman kings, succeeding his brother-in-law, Servius Tullius. The dates of his reign are given as 534 to 510 B.C., when he was overthrown and expelled by the Roman people because of his unjust rule. Though he tried to retake the city, his attempt to regain power failed, and the republic was established in 509 B.C. Macaulay's poem "Horatius at the Bridge" is based on this legend. See also ROME, HISTORY OF; SERVIUS TULLIUS.

TARSIER, *tahr'sih ur,* a peculiar animal related to the monkeys and lemurs. An inhabitant of the East Indies, this furry little creature reaches a total length of about sixteen inches, nine inches of which are taken up by the thin, sparsely haired tail. It is distinguished by its enormous round eyes, which resemble a cat's eyes in that the pupils contract to mere slits under bright light. The tarsier's long hind legs are adapted for hopping, and each of its fingers and toes is provided with a suckerlike disc for clinging to branches. In addition, the nails of the second and third toes are modified into claws. At night the tarsier searches about for insects and other food, but during the day it hides from sight.

Scientific Name. Common tarsier, *Tarsius tarsier.*

TAR'SUS, TURKEY, a small trading center in southeastern Asia Minor, is remembered as the birthplace of the Apostle Paul and as one of the historic cities of the ancient world. It is located about ten miles from the Mediterranean. During ancient times it had an extensive trade both by land and by sea; the Cydnus River, which flowed through the city, carried much shipping. At the beginning of the Christian Era, Tarsus was a wealthy and cultured city with a famous university. Modern Tarsus has much local trade in a fertile farming region. The population is about 24,000.

TAR'TAN, a plaid fabric, originally of wool, in various colors and patterns, and also the pattern itself. Such plaids, made by using yarns of different colors in both the warp and the filling, were produced by early weavers. Since the Middle Ages every clan of Scottish Highlanders has been known by its own tartan. Each member of the clan is entitled to wear the clan plaid in the kilt and in the scarf that crosses from one shoulder to the belt. Tartans are made in twill weave of lightweight wool, wool and cotton, silk, or silk and cotton.

TAR'TAR EMET'IC, a poisonous drug prepared by heating antimony trioxide and potassium tartrate in water. It occurs as transparent crystals or as a white powder and is soluble in water and in glycerin. Tartar emetic is useful as an expectorant, small doses inducing the patient to cough up mucus and other fluids that have accumulated in the respiratory tract. Since large amounts will cause vomiting, the drug has been used at times as an emetic. But this use has been abandoned because other serious effects may accompany the vomiting. Tartar emetic is also employed in the treatment of a tropical disease called schistosomiasis and is used in the dyeing industry as a mordant.

TARTAR'IC ACID, an odorless compound of carbon, hydrogen, and oxygen, sour in taste, is found in juices of many fruits and vegetables, especially grapes. Its large rhombic crystals are transparent and colorless and dissolve readily in water and in alcohol. The acid itself has uses in medicines, in effervescent beverages, in photography, and as a mordant solvent in the dyeing and printing of textiles.

An important commercial source of tartaric acid is argol, the hard, crusty deposit in wine casks and fermenting vessels. Argol is largely crude potassium bitartrate, which when purified is the cream of tartar used in baking powders. Two other important salts (tartrates) of the acid are tartar emetic (potassium antimonyl tartrate) and Rochelle salt (sodium potassium tartrate), used in medicine as a diuretic, purgative, and an ingredient of Seidlitz powders, and in the

TASMANIA AND ITS ISLAND DEPENDENCIES, with an area greater than that of West Virginia, constitute the smallest of the Australian states.

preparation of Fehling's solution, important as a test for the presence of various sugars and other reducing agents. See also Baking Powder; Seidlitz Powders; Tartar Emetic.

TAR′TARS. See Tatars.

TARTARY, *tahr′tuh rih,* a name applied in the Middle Ages to the homeland of the fierce and warlike Mongols who invaded Europe during the thirteenth century. The name was extended to the region inhabited by all the Turko-Mongol peoples, including Manchuria, Mongolia, Turkistan, and the southern part of present-day Russia (both Asiatic and European). Today the term is generally restricted to Turkistan. See also Tatars; Turkistan.

TASHKENT, *tash kent′,* Soviet Russia, the capital of Uzbek Soviet Socialist Republic, is the largest city of Asiatic Russia and the economic and cultural center of Central Asia. It is situated in a large oasis along a tributary of the Syr Darya River, which empties into the Aral Sea and which supplies water for irrigation and power for industry. Tashkent is a modern city with large factories, a great university, a museum, and libraries; yet its native section has clay-built houses, bazaars, and mosques. The chief manufactures are cotton and silk textiles and agricultural machinery. The city carries on trade with Iran, Pakistan, and India. The population is about 585,000.

TASMANIA, *taz ma′nih uh,* one of the six states of the Commonwealth of Australia, consists of the island of Tasmania and many adjoining islands. Tasmania is an irregular heart-shaped island situated about 140 miles south of the southeastern extremity of the continent, from which it is separated by shallow Bass Strait. The island extends about 180 miles from north to south and 190 miles from west to east; with its dependency islands it has an area of 26,215 square miles.

Tasmania has many mountain ridges and peaks, the highest of which is Ben Lomond (5,160 feet) in the northeast. Much of the interior is a plateau with an average elevation between 2,000 and 3,000 feet. In this central highland are a number of picturesque lakes, the largest being Great Lake with an area of about 50 square miles. The principal river is the Derwent, which is navigable for a short distance above Hobart, the capital. The King River in the west has a magnificent gorge about 3,000 feet deep. The climate of Tasmania is cool and moist but extremely variable; snow seldom falls on the island except in the mountains.

Resources. Since about two thirds of the island is too rugged for farming, agriculture is less important in Tasmania than in the other states of Australia, and much of the food must be imported. The chief crops are apples, potatoes, peas, oats, and wheat, and large numbers of sheep and dairy cattle are raised. Lumbering is an important industry. The chief mineral products are zinc, copper, lead, and tin; while the coal and iron-ore deposits are extensive, they have been little exploited. The most important industries are metal extraction and fruit preserving. Hobart, in the south, and Launceston, in the north, are the leading seaports. The main railway connects these two ports; there are a number of other rail lines and branches, but much of the interior is without adequate service.

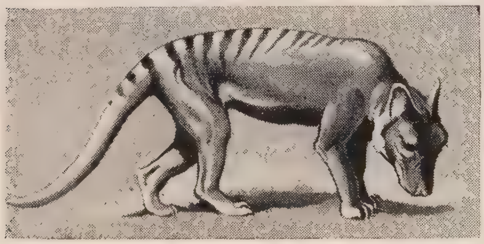
History and Government. Tasmania was discovered in 1642 by the Dutch navigator Abel Janszoon Tasman, who named it Van Diemen's Land in honor of the Dutch statesman who had sent him on the exploring expedition. The settlement of the island began in 1803 when Great Britain took it over and sent a group of convicts there. The primitive natives, originally numbering about 5,000, were virtually exterminated, and in 1831 about 200 survivors were removed to Bruni Island. Van Diemen's Land was separated from New South Wales and made a separate colony in 1825. In 1853 the transportation of criminals into the island was stopped, and the name of the island was changed to Tasmania; three years later a representative government was set up. Tasmania continued as a separate colony until 1901, when it joined in the formation of the Commonwealth of Australia.

The nominal head of the state is a governor appointed by the British Crown, but the real executive power is in the hands of a premier and other cabinet ministers who are fully responsible to an elective parliament of two houses. The population is about 257,000. See also Australia; Hobart.

TASMANIAN DEVIL, an Australian mammal belonging to the group known as marsupials. The Tasmanian devil somewhat resembles a badger but has a larger head and is clothed with short, black hair marked about the throat and sides with white. Its heavy, low-slung body measures almost three and one-half feet in length, including the twelve-inch tail. The Tasmanian devil feeds on small animals and is sometimes bloodthirsty enough to attack sheep. After the young are born, they are carried about in the mother's pouch for several months. See also MARSUPIALS.

Scientific Name. *Sarcophilus ursinus.*

TASMANIAN WOLF, a doglike marsupial once found over the entire Australian region but now restricted to Tasmania. It has an over-all length of about five feet, including the long, tapered tail, and is covered with a short, grayish-brown coat marked with dark stripes across the hindquarters. As in all marsupials, the female is equipped with a pouch for carrying the young. Because the Tasmanian wolf, or *thylacine,* is very destructive to livestock, it has been practically exterminated by man in many places and is now rarely seen. See also MARSUPIALS.



A SAVAGE KILLER in the wild state, the Tasmanian wolf becomes quite docile in captivity.

Scientific Name. *Thylacinus cynocephalus.*

TASSO, *tahs'soh,* TORQUATO (1544-1595), Italian poet, the author of the epic *Jerusalem Delivered,* was born near Naples. The boy was a brilliant student, and his father, the poet Bernardo Tasso, sent him to Padua to study law. He soon turned to literature, and at eighteen he wrote a long epic poem called *Rinaldo (Roland).* Tasso settled at the court of Ferrara, where he became a favorite of the ruling family. In 1573 he wrote the delightful pastoral drama *Aminta. Jerusalem Delivered,* his great epic on the capture of Jerusalem by the knights of the First Crusade, was completed when he was thirty. Godfrey de Bouillon, Tancred, and Rinaldo are the chivalric heroes of the poem. Before the work was published, Tasso began to show symptoms of mental derangement, and eventually he was confined for a time as a madman. During his last years he wandered unhappily from city to city. His great work, published without his permission during his illness, achieved great popularity, but Tasso did not profit by it. Pope Clement VIII finally granted him a pension and invited him to Rome, where he was to be crowned with laurels in recognition of his genius, but Tasso died before the ceremony could be performed. See also GODFREY DE BOUILLON; TANCRED.

TASTE, the sensation that occurs when a soluble substance comes in contact with the taste buds in the mouth. In man, taste buds are present on the tip, sides, and back of the tongue, on the roof and back of the mouth, and in the region of the epiglottis. They consist of small groups of cells which are embedded in the mucous membrane and open out into pits in the membrane. When food is dissolved in the mouth, it flows into the pits, the taste buds are stimulated, and nerves connected with the taste buds carry the impulses to the brain. There are only four kinds of tastes — sweet, sour, bitter, and salty; all others are combinations of these. Each taste bud reacts to one of these tastes. Experiments have shown that the taste buds specialized for sweet and salty are located at the tip of the tongue, those for bitterness at the base, and those for sourness along the sides.

Taste is not an independent sense but is closely related to the senses of smell and feeling. That it is intimately connected with the sense of smell is obvious to anyone who has ever suffered from a head cold severe enough to make all food seem tasteless. Another way to judge the relationship between taste and smell is to blindfold a person and close his nostrils; he will find it difficult to distinguish the taste of an apple from that of an onion. The way a particular substance feels while it is being eaten greatly influences its taste. For example, foods that normally are served crisp lose much of their flavor when they become wilted or soggy. Temperature also affects taste, warmth enhancing the taste reaction and coldness inhibiting it. Drinking alcoholic beverages and smoking tend to dull the sense of taste.

Some persons earn a living by tasting samples of wine, coffee, tea, milk, chewing gum, toothpaste, or various foods. These professional tasters have a taste sense so delicate and highly developed that they can distinguish the slightest variations in the flavor of a product. Some wine tasters, for example, are skillful enough to be able to name the year of vintage of a particular sample, and in London there is a professional water taster who can identify water samples from various parts of the city. See also SMELL.

TATARS, *tah'turz,* or **TARTARS**, the name given to various peoples in Asia and Europe. The Tatars of central Russia are the descendants of the Golden Horde, Mongolian invaders who, in the thirteenth century, set up a state between the Don and the Volga rivers. Their leaders ruled Russia for more than two hundred years. The inhabitants of the Crimea are mainly Tatars, and there are Tatar colonies in Rumania and Bulgaria. The Tatar population of Soviet Russia is probably about 3,000,000. The languages spoken by the Tatars, the Turks, and the Huns, who invaded Europe in the fourth century, belong to the same language family. The ancestors of these people probably lived on the plains of Central Asia in prehistoric times. They made many migrations to the west, bringing into Europe a great mixture of races, languages, and customs. See also MONGOLS.

TATTOO'ING, a form of body decoration common among primitive peoples and traditional with seamen. Tattooing is done by pricking the skin with a sharp point and rubbing ink or other coloring matter into the tiny punctures, so that a permanent design is produced. Professional tattooers in many cities use electric needles, which pierce the skin and inject the dyes. In primitive societies tattooing may be done for decoration, to indicate rank or status, or to gain magic power through the use of sacred symbols. Among some Eskimo groups a married woman may be recognized by three lines of tattooing on the chin. Instead of tattooing, some people use scarification, cutting the skin and irritating the wounds in order to produce patterns of scar tissue.

TAURUS, *taw'rus,* the Bull, a zodiacal constellation north and west of Orion, contains several rather unconnected groups of stars. Aldebaran, a first-magnitude star of reddish color, is near a V-shaped star cluster, called the Hyades, which represents the face of the bull. Above are two stars that mark the horns. South of the Pleiades, a smaller cluster to the west of the Hyades, are four faint stars representing the bull's forequarters. The Hyades, in mythology, were said to be half sisters of the Pleiades. They wept so much over the death of their brother Hyas, it was said, that their tears fell to the earth as rain. They are often called the rainy or the watery Hyades.

Taurus is also the name given to the second sign of the zodiac (see ZODIAC). See also ASTRONOMY; ORION; PLEIADES.

TAX. When people live together in a community or in a nation, there are certain activities which are carried on for the benefit of all. For example, streets and roads are paved, schools are made available, and police and fire departments and armies are maintained. To finance these and many other activities, individuals pay sums of money called taxes into a common fund.

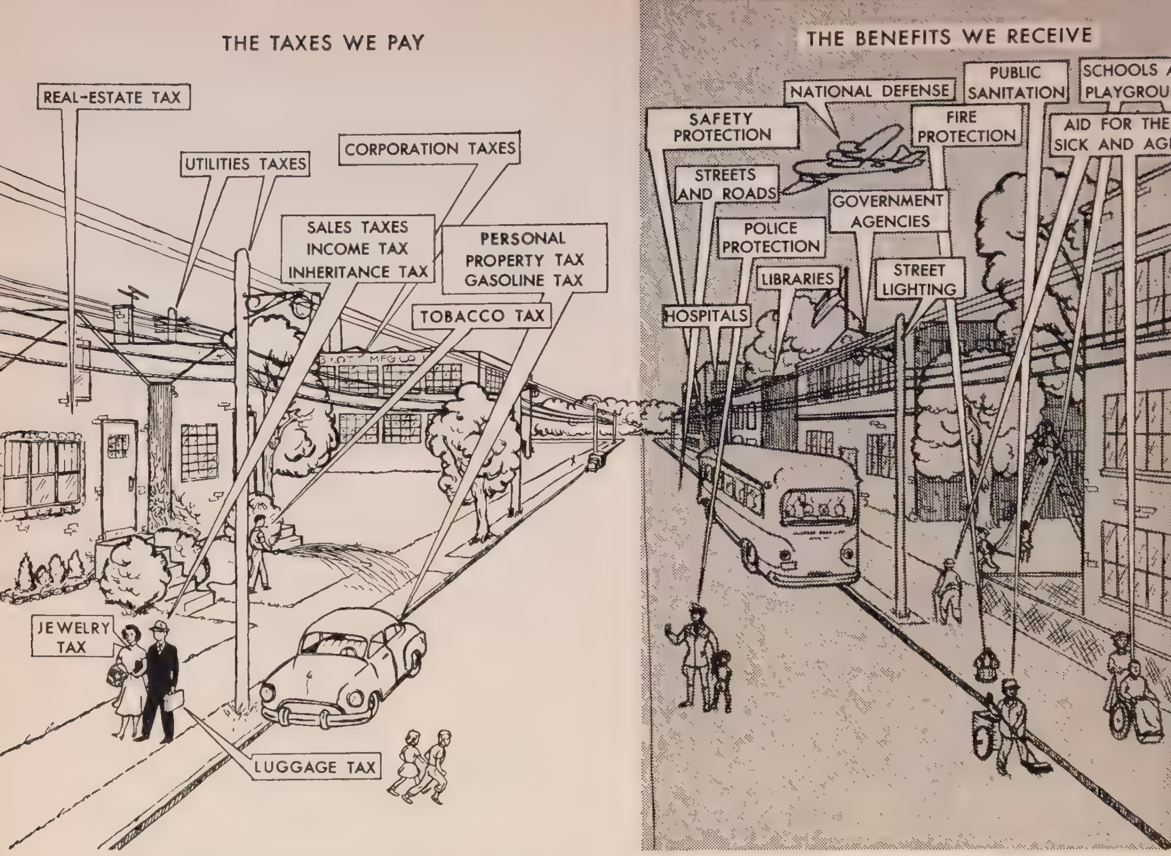
Today, in the civilized countries of the world, governments do much more for the common citizen than they did in centuries gone by. They have taken many steps to safeguard health and property and to provide educational facilities; they have established various systems to care for the aged, infirm, and unemployed; they have expanded numerous services which supply reports on business activities, farm crops, weather, navigation, and many other matters of special interest to various groups of citizens. An ever-increasing proportion of one's total expenditures goes, as taxes, to pay for such services.

What Are Taxes? A tax may be defined as a compulsory payment levied by legal authority upon private property or income, to defray the expenses of government or for other public expenses. Today, in countries where the free-enterprise system of production functions, nearly all public revenue is derived from taxation. Fees, licenses, and special assessments are minor sources of income. Fees, which may go to public officials rather than into the public treasury, are payments for services rendered; licenses are paid for various privileges, such as the privilege of driving a car; and special assessments are charges made against property owners for improvements, such as the paving of streets, which are likely to increase property value. By contrast, taxes must be paid without reference to benefits received. For example, the schools of a city are supported in part by money received from taxes on real estate. These taxes are paid by all property owners, whether or not they have children to attend the schools.

Principles of Taxation. Adam Smith, the British economist who wrote *Wealth of Nations* (1776), laid down four principles of taxation which have been widely accepted: (1) the citizens of every state should contribute to the support of the government as nearly as possible in proportion to their respective abilities to pay; (2) the tax should be certain, not indefinite or inconsistent; (3) every tax should be levied at the time, or in the manner, most convenient to the taxpayer; and (4) every tax should be so contrived as to take out of the pockets of the people as little as possible above what it actually brings into the public treasury.

Modern practice greatly modifies Adam Smith's first principle. With the income tax, for example, much higher rates are charged on large incomes than on small, in contrast to the principle of an equal proportion for all. The fourth principle, which involves economy, has been expanded; the fact has been recognized that a tax may be so high that it discourages initiative and investment, burdens consumers, and hampers progress.

Two additional principles are added by most political economists: (1) the taxes as



A TYPICAL SCENE ON A CITY STREET offers numerous examples of the taxes collected by local, state, and national governments and of the uses to which the tax money is put for the benefit of all the people.

a whole must yield enough revenue to meet the fiscal needs of the government; and (2) they must be flexible enough to meet changing economic and political conditions. No tax or tax system can meet all of these requirements, but in many cases the faults of one tax are offset by the virtues of another.

Kinds of Taxes. According to popular classification, taxes are divided into direct taxes, which are actually borne by the persons who pay them, and indirect taxes, which are commonly shifted by the taxpayer to someone else. The poll tax is the best example of the direct tax, but usually the income and general-property taxes are also direct. Indirect taxes, such as customs duties and real-estate taxes, are often considered costs of production and are passed along to the public in higher prices. When imposed on commercial and industrial property, a property tax can thus become an indirect tax.

General property taxes may be levied on all kinds of property, both real and personal, or on selected forms and classes of property. All property is assessed by value; the tax rate is computed from the revenue need and the assessment list, and the rate is then applied to the total assessment of each property owner. The real-estate tax collected from a property owner in an American county may be divided among the county government, city government, school department, park service, department of sanitation, and other public bureaus and agencies. In an industrial society, most personal property is concealed from the assessor, and most of the tax burden falls on land and other real property, which cannot be hidden. Because it is extremely unfair as a measure of ability to pay, the property tax has become hardly more than supplementary in most modern countries. See SINGLE TAX.

The *income tax,* now the most productive tax in the leading countries of the world, is a percentage of the income of individuals and corporations. In most countries the rates are progressive; on very large incomes the tax may take 80 per cent or more of the income. The payment of the income tax is put on a current basis for most wage earners through the withholding tax, by means of which the money is deducted from the source of the income and paid directly into the public treasury. The excess-profits tax, which is actually an income tax, is often imposed during wartime in order to drain off abnormal wartime profits and to prevent profiteering. See INCOME TAX.

The *poll tax* is levied on the person of the taxpayer. Since it is equal for all, it has no relation to ability to pay. It is not unfair in primitive societies, but in modern countries it is seldom used. See POLL TAX.

The *sales tax* is levied as a percentage on gross sales of commodities. It may be imposed on the sale of all articles or on a selected list. The retail merchant pays the tax to the public treasurer, but he adds it to the selling price and therefore receives it from the consumer. The sales tax is highly productive and has been widely adopted, although it is criticized as unfair to the person of low income, who must spend a larger proportion of his income on such basic essentials as food and clothing than does the wealthier man. It has been supplemented in some American states by a use tax on goods purchased outside the state on which no sales tax has been paid.

Inheritance taxes and *estate taxes* are imposed on the property transferred from a deceased person to his heirs. The rates are usually progressive. This type of tax has been widely adopted in democratic countries to break up great fortunes. See INHERITANCE TAX.

Customs duties are taxes on goods coming into a country. Some countries also impose duties on exports. Once a chief source of revenue in many countries, tariff duties are now employed chiefly to protect home industries from foreign competition. See CUSTOMS DUTIES; TARIFF.

Excise taxes are levied on the manufacture, sale, or consumption of goods within a country. Also included are licenses on certain occupations and business transactions. Most excises are actually sales taxes. In the United States, excises include taxes on liquor, amusements, business licenses, and numerous other articles and privileges. See EXCISE TAX.

Special taxes include those for social security and, in most countries, for unemployment compensation and old-age security, usually in the form of contributions from employees or employers or both. Where health insurance is in effect it usually is financed by taxes such as these. See SOCIAL SECURITY.

The United States. The Federal Constitution empowers Congress to levy taxes, duties, imposts, and excises to pay the debts and provide for the common defense and general welfare. All taxes must be uniform throughout the United States, and no taxes on exports are permitted (see Art. I, Sec. 9). During its early history the Federal Government relied mainly on tariff duties. Excise and other taxes were adopted early in the nineteenth century only to be soon abolished, but with the War between the States excise taxes became permanently established. The income tax did not become permanent until the passage of the Sixteenth Amendment in 1913. It now supplies more than three fourths of the Federal income.

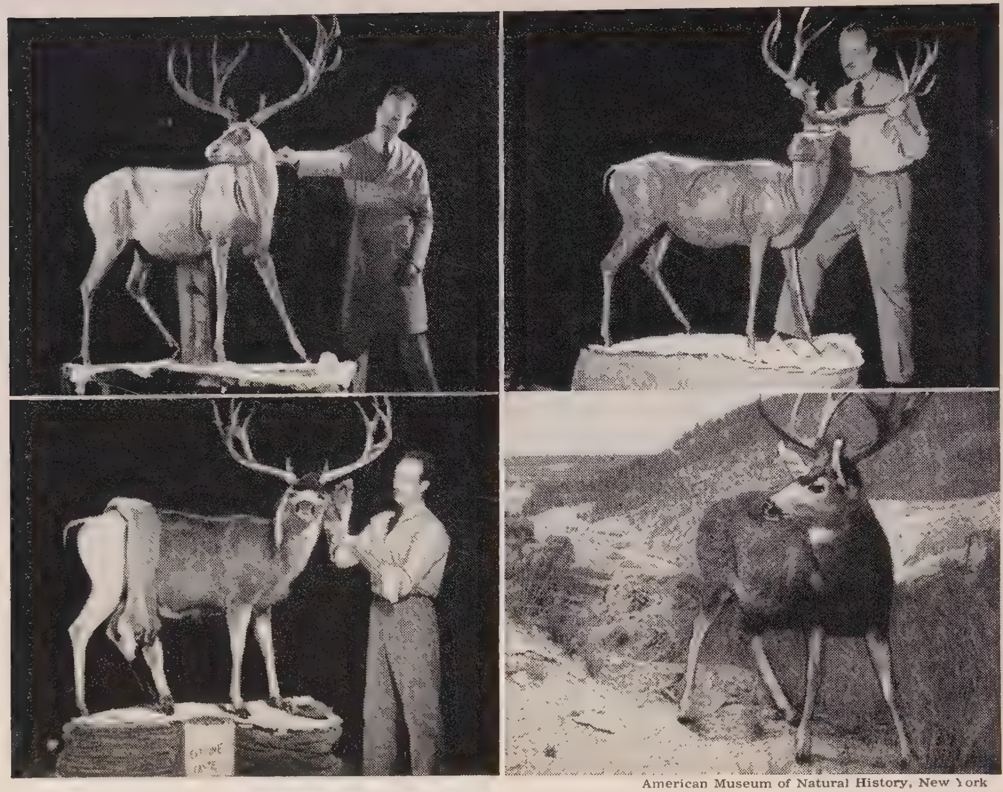
For many years the states relied chiefly on the general property tax and on direct taxes against business. After World War I motor-vehicle and motor-fuel taxes were widely adopted for the construction and maintenance of public highways. The sales tax came into general use during the depression years of the 1930's. Local governments rely chiefly on the general property tax.

The British Commonwealth. The income tax normally produces about two fifths of the national revenue in Great Britain, about one half in Canada, more than half in Australia, nearly half in New Zealand, and about 35 per cent in the Union of South Africa. Other major sources of revenue are customs, excises, and estate taxes. In Britain, after World War II, taxation took 40 per cent or more of the total national income.

When the Canadian provinces joined in political federation, they gave up to the Dominion their individual customs and excises in return for subsidies from the government. The provinces obtain revenues from forests, fisheries, and minerals, and they levy taxes on corporations, incomes, inheritances, real and personal property, motor vehicles, gasoline, and amusements. The Australian states receive most of their income from taxes on business undertakings and property.

History. Modern taxes are a recent development, although taxation in one form or another is an ancient practice. In early times kings received revenue from war booty, from tribute imposed on foreigners and members of certain despised professions, from so-called "voluntary" offerings made by their own people, and from the income of the royal estates. Although citizens resisted the payment of direct taxes, which were regarded as tribute, the voluntary presents finally developed into moral and then into legal obligations to their rulers.

Direct taxes probably began as poll, or head, taxes, which developed out of the obligation of the subject to render personal service to his chief. At first the poll tax was the same for all, but eventually it was adjusted according to the ability of the individual to pay. Resistance to direct taxes forced rulers to resort to other methods, such as collecting fees for services, customs duties on imports and exports, excises on articles in common use, and license fees for privileges. The land tax also had a long development. At first it was customary to make voluntary offerings in kind, or produce, usually amounting to a tenth of the yield of the land. In time the tax came to be determined by the value of the property.



American Museum of Natural History, New York

IN PREPARING THE MALE MULE DEER for a museum mule deer group, the taxidermist models the animal in clay, attaches the horns to the manikin made with a plaster mold of the clay model, and finally fits the tanned skin over the manikin.

In ancient times the collection of taxes was often contracted to the highest bidder. Such professional tax collectors, the publicans of the Bible, were hated for the brutal methods they used. During the Middle Ages and the centuries immediately following, the general property tax was the chief assessment. After 1600, as governmental expenses increased, many excise taxes were placed on the necessities of life. With the rise of the democratic movement in the nineteenth century, however, these excises, regarded as a terrible burden on the poor, were greatly reduced. During the latter half of the nineteenth century the income tax was widely adopted in the Western world; today it is the chief source of revenue for most countries.

Since 1800 taxation has been a vital part of democratic governments, which have used tax receipts to finance a multitude of welfare services for the people. Taxes have soared to meet the cost not only of these services but to pay for war expenditures and military preparedness. In some democratic countries taxation has been used to gain social and political objectives, as well as for revenues; for example, income and inheritance taxes are often designed to reduce inequalities in wealth. Some economists have suggested that national governments should use their taxing power to control economic booms and depressions, by taxing beyond need in boom times and spending beyond income, to increase purchasing power during depressions.

See also INTERNAL REVENUE.

TAX COURT OF THE UNITED STATES, a special agency of the Federal Government established to settle controversies over the payment of Federal taxes. This court was created in 1943 to replace the former United States Board of Tax Appeals. The tribunal may hear cases involving charges of overpayment or underpayment. Usually the case arises when the Collector of Internal Revenue rejects the taxpayer's income-tax return and requests the payment of additional taxes; the taxpayer may then appeal the issue to the Tax Court. In some cases, decisions of the Court are final; other decisions of the Court may be appealed to the Federal Circuit Court of Appeals, and even to the United States Supreme Court.

TAX'ICAB, a motor vehicle specially licensed to carry passengers for hire and used in most modern cities of the world. It is usually equipped with an automatic device for registering mileage or time consumed and for indicating the amount of fare. City ordinances fix the rates and regulate the service. Rates of fare vary according to distance and other circumstances; some cities are divided into zones, the fare increasing as the taxi passes from one zone to another. Sometimes additional passengers must be carried without extra charge.

A horse-drawn vehicle called the *cabriolet* appeared in Paris about the middle of the seventeenth century. When this type of vehicle was introduced into London, the name was shortened to *cab*. The *hansom,* or *hansom cab,* was a two-wheeled vehicle very popular during most of the nineteenth century. The horse-drawn cabs were replaced by motor cars at the beginning of the automobile age.

TAX′IDERMY is the art of preserving and mounting animal skins so that they resemble living animals. Examples of taxidermy at its best may be seen in the natural-history museums of the world, where reconstructed animals are displayed in their natural settings. In preparing these exhibits, lifelike animal models are constructed and the skins placed over them. The expert taxidermist, therefore, must understand not only tanning and dyeing but also natural history, anatomy, drawing, and sculpture. Taxidermy provides both a fascinating hobby and an interesting means of earning a living.

The process of preparing a mounted animal for exhibition begins in the field as soon as the animal is captured. Exact measurements and sketches of the dead animal are made and set aside for later use in constructing the model. By skillful cutting, the animal is then skinned, the leg bones and skull are cleaned, and the skin is treated with a preservative, such as arsenical soap or one of the special commercial preservatives.

The taxidermist is now ready to make a model on which the skin may be mounted. He begins by constructing a wooden framework to which the leg bones and skull are attached by means of metal rods; this structure is called an *armature*. Next, the armature is covered with clay or papier-mâché, and with the aid of the field notes the taxidermist carefully models the animal's muscles and contours. He then makes a mold by applying a mixture of plaster and fiber to the clay model.

When the plaster mold is dry, it is removed and painted with glue. Several layers of burlap, which has been soaked in plaster, are then carefully worked onto the mold. As soon as this has set, the glue is softened with steam or hot water, the burlap form is removed from the mold and put together, and iron rods are inserted in place of the leg bones. This hollow, lightweight but sturdy model is known as a *manikin*. The tanned hide of the animal is glued to it and sewed together. After glass eyes have been added and the fleshy parts of the hide colored and polished, the mounted animal is ready for display.

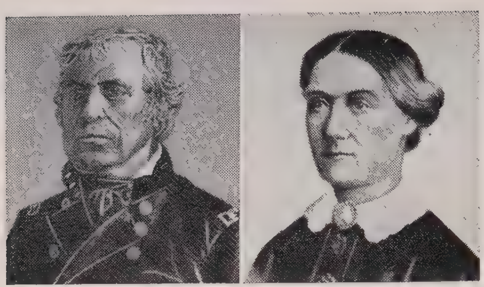
The process just described is used mostly for medium-sized or large specimens. Smaller animals, such as birds and squirrels, may be prepared by less complicated methods. Skins of these animals are often treated with borax and then stuffed with excelsior; wires are inserted to support the neck, legs, wings, and tail. Detailed instructions for preparing mounted animals may be obtained from most natural-history museums and also from the many books on taxidermy available in libraries and book shops.

TAYLOR, DEEMS (1885-), American composer, music critic, and writer, born in New York City, is known for the popular orchestral suites *Through the Looking Glass* and *Circus Day* and for two successful operas, *The King's Henchman* (libretto by Edna St. Vincent Millay) and *Peter Ibbetson*. Both were produced at the Metropolitan Opera. He also wrote cantatas, songs, and symphonic poems. In the midst of a career as a composer, Taylor found time to be a music critic and editor, author, and radio commentator. Among his books are *Of Men and Music* and *The Well-Tempered Listener*.

TAYLOR, ZACHARY (1784-1850), twelfth President of the United States, spent forty years in the regular army and won national fame with his victory at Buena Vista during the Mexican War. Sixteen months after his inauguration death cut short an administration marked by bitter disputes between the free states and the proslavery South.

Early Career. Zachary Taylor was born at Montebello, in Orange County, Virginia, on November 24, 1784, to Mary Strother Taylor and Richard Taylor, member of a prominent family of the slave-owning tidewater planter class. He grew up, with little formal schooling, near Louisville in Kentucky, then a frontier county of Virginia. In 1808 he became an army lieutenant. He took part in action against the Indians in Indiana Territory in 1812, fought in the Black Hawk War, and defeated the Seminoles of Florida in the Battle of Lake Okeechobee. As a brigadier general, in 1840 he became military commander in the Southwest.

The Mexican War. In May, 1844, Taylor was ordered to protect Texas, then an independent republic, against a threatened Mexican invasion. The next year, after Texas had been annexed by the United States, he was sent to support Texans' claims to disputed territory above the Rio Grande. Early in 1846 his troops were ordered closer to the river. After a raid across the river by Mexi-



Brown Brothers

ZACHARY TAYLOR married Margaret Mackall Smith in 1810, the year in which he achieved the rank of captain in the army.

can forces, Congress on May 12, 1846, declared war against Mexico.

Marching south, Taylor's men took the city of Monterrey in September, and Taylor agreed to a six-weeks' truce, apparently thinking that peace could be secured. President Polk, disapproving of his action, placed General Winfield Scott in command of an army drawn in part from Taylor's forces and directed at Mexico City by way of Veracruz. Taylor, deprived of some of his best troops, was supposed to maintain his position at Monterrey; but instead he advanced southward. On February 22 and 23, 1847, at Buena Vista, he conquered the much larger army of Santa Anna, ending the war in the north almost seven months before Scott's capture of the capital concluded hostilities.

Entry into Politics. Taylor's victories made him a national hero and a possible candidate for President. As a soldier, husky, hearty "Old Rough and Ready," as he was called, had many admirers; as the owner of a Louisiana plantation and as the kinsman of distinguished families in Kentucky and Virginia, he had strong appeal in the South and West. While he had never voted, he was a Whig by preference. He had attracted the attention of Whig leaders as early as 1846, and although he publicly denied any interest in political office, the Taylor movement made rapid progress. Finally giving in to persistent urging, Taylor announced that, if elected President, he would follow a nonpartisan policy. On the all-important slavery question he held to a middle-of-the-road position, at the same time defending states' rights in a manner that heartened the South.

Despite competition from Henry Clay, Daniel Webster, and General Scott, Taylor received the Whig nomination on the fourth ballot, with Millard Fillmore as his running mate. In order to avoid the slavery issue, neither party presented a platform. Taylor carried fifteen states, of which eight were slave. Although Taylor received 163 electoral votes to 127 for Lewis Cass, the Democratic candidate, the popular vote was closer, and the change of a few thousand votes in New York would have given Cass the Presidency.

Taylor's Administration, 1849-1850

In this critical time the Union consisted of fifteen slave and fifteen free states. The South could expect no more slave states to maintain a balance unless they should be carved from the territory newly won from Mexico. On the other hand, Oregon and Minnesota were almost ready for admission as free states. The threat to the balance was further increased by the probability that California and New Mexico would ask for admission as free states. More accustomed to direct action than to political strategy, the new President sent an agent to advise California and New Mexico to prepare constitutions and apply for admission when Congress should meet. California acted before the agent arrived, adopting a free-state constitution, and New Mexico and the Mormons in Utah adopted free-state constitutions soon afterward.

When Congress met, Taylor's recommendation that California and New Mexico be admitted unconditionally angered the Southern Representatives. In May, 1850, Texans were enraged by his proposal that the Federal Government hold territory in dispute between Texas and New Mexico until final settlement. There were open threats of disunion in Congress, and a convention of Southern delegates was arranged to meet at Nashville in June to discuss joint action. Taylor thereupon announced that he would use armed force to preserve the Union.

Taylor was helped little by his undistinguished Whig Cabinet members, most of whom came from the South. The one diplomatic agreement of interest was the Clayton-Bulwer Treaty of 1850, in which the United States and Great Britain each promised never to seek to dominate any canal ever built across Central America (see CLAYTON-BULWER TREATY). But if the administration was weak, Congress was strong. Its members included Clay, Webster, Calhoun, Seward, Chase, Douglas, and Jefferson Davis. Clay sought compromise; Webster supported his suggestions; opposition was voiced by Calhoun representing the Southern point of view and Seward representing the Northern.

Death of the President. Taylor opposed Clay's compromise, which would have set up merely territorial governments in Utah and New Mexico, and he would probably have vetoed it. It is likely, too, that he would have used force to suppress any attempt at secession. He had no opportunity to act, however, for on July 4, 1850, he was taken suddenly ill, and five days later he was dead. The Compromise, consisting of five separate provisions, was enacted under his successor, Fillmore (see Compromise of 1850).

Taylor and his wife, Margaret Mackall Smith, had five daughters, one of whom married Jefferson Davis, and a son, Richard, who later won distinction as a Confederate officer.

America Under President Taylor

The year of Taylor's inauguration gave its name to the "Forty-Niners," the men who streamed into California by the tens of thousands in search of gold (see California, *History*). The population of the country exceeded 23,000,000, and immigration into America from Europe in that year approached the half-million mark. At mid-century American clipper ships were in the midst of their futile struggle to prove that steam could not replace sails on the high seas. Inland, railroads were rapidly replacing canals as freight conveyors. Stimulated by the opening of the Far West, popular demand spurred the production of improved means of transportation.

Most Americans lived east of the Alleghenies, but the importance of the West was growing steadily. Although the South, as the source of the great bulk of the world's cotton, seemed to be flourishing, Southern leaders were worried by the fact that more and more Western produce was going to Eastern, rather than to Southern, markets, thereby weakening the South both economically and politically. In the North, technical improvements and ambitious water-power projects were aiding industrial progress. Not only was the stage being set in Zachary Taylor's day for the War between the States, but the trends and developments during his administration were helping to determine its outcome.

TBILISI, *t'pih'lih sih.* See Tiflis.

TCHAD, Lake. See Chad, Lake.

TCHAIKOVSKY, *chy kawf'skee,* Peter Ilich (1840-1893), Russian composer, was born in Votkinsk, in the Ural region. Since his father, a distinguished mining engineer, did not approve of a musical career for his son, young Tchaikovsky spent nine years studying law. At twenty-two, he gave up a job in the Ministry of Justice to enter the Conservatory of St. Petersburg, where he studied under the great pianist and composer, Anton Rubinstein.

From 1865 to 1878 Tchaikovsky earned his living by teaching musical theory at the new Moscow Conservatory. His first great works, the *Romeo and Juliet* fantasy-overture, the Piano Concerto in B Flat Minor, the tone poem *Francesca da Rimini,* and the song "None but the Lonely Heart," date from this period. In 1877 a wealthy widow, Madame von Meck, arranged to give the composer an allowance so that he could give up teaching and turn all his energies to composing. She and Tchaikovsky chose never to meet, but they corresponded intimately during the thirteen years that the arrangement lasted. In the first year of freedom from financial problems he produced the Fourth Symphony, the violin concerto, and the opera *Eugene Oniegin.*

Tchaikovsky made several extended concert tours in Europe, and in 1891 he conducted one of his compositions at the dedication of Carnegie Hall in New York. He died of cholera just after the first performance of his Sixth Symphony, the famous *Pathétique.*

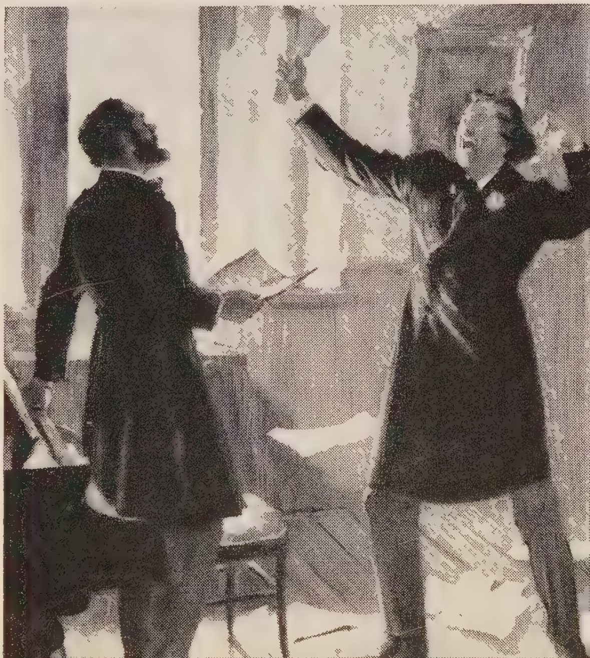
Alternating between gaiety and deep melancholy, Tchaikovsky's music reflects the intensely emotional character of the composer. Probably no musician has given the world so many beautiful melodies. He left six symphonies, of which the last three are among the best known in the concert repertory; many songs; three quartets and a trio; three famous ballets, *Swan Lake, Sleeping Beauty,* and the *Nutcracker;* three piano concertos and one for the violin; and many other works for orchestra and for the piano.

TEA, an evergreen plant native to southeastern Asia, its leaves, and the tremendously popular beverage made from the leaves. Tea is the most popular drink in the world, after water. World consumption is about two billion pounds a year.

Tea Growing. The tea bush is a remark-

CONDEMNED AS WORTHLESS by the celebrated director of the Moscow Conservatory, Tchaikovsky's Concerto in B Flat Minor won great popularity both as a classical selection and as the ballad "Tonight We Love."

The Magnavox Company



ably hardy plant that will grow almost anywhere in the latitudes between Boston and Buenos Aires and from sea level up to an altitude of 7,000 feet. It does best in tropical or subtropical climates with high humidity and ample moisture; and while it has been grown on every continent, including North America, the bulk of the world's supply comes from India, Ceylon, Java, Sumatra, China, Japan, Formosa, Indo-China, and Africa.

The quality of the leaf is affected by altitude, soil, temperature, rainfall, and general climatic conditions. Teas from the higher altitudes are generally superior in quality to those grown at lower levels. The high mountain plateaus of India produce some of the finest; the leaf grown on the slopes of Darjeeling cannot be surpassed.

If it were not kept pruned, the tea bush would become a tree and the leaves would grow coarse. The plant is usually kept between two and six feet high. The dark green, narrow leaves are about four inches long, and the fragrant, cream-colored flowers are shaped like a camellia.

On a tea plantation where modern methods are used, selected tea seed is put in a nursery to develop before it is transplanted to the best available land. In some regions bushes begin to yield in two or three years, and under skillful cultivation they may continue to bear quality leaves for more than a century. In warm, moist lands the leaves may be picked about every two weeks without harming the plant; only three of the tenderest leaves are taken from each twig.

Curing the Leaf. Teas are classified as black, green, or oolong, according to the way the leaf is treated after it is picked. For *green* tea, the leaves are withered and heat-treated almost as soon as they are gathered. Leaves to be made into *black* tea are kept in a dark, humidified room for several hours before they are fired. This treatment brings out the natural leaf juices and develops the essential oil of tea. *Oolong* tea represents a curing process between the other two. Black tea comes principally from India, Ceylon, and Indonesia. Most of the Japanese and Chinese teas are green, and oolong is produced mainly in Formosa.

After the leaves are cured, they are put through a series of sieves and separated into commercial sizes and grades. Grade names, such as Orange Pekoe, refer to leaf sizes and not to the quality of the tea. Generally the smaller leaves are more desirable than larger, coarser ones.

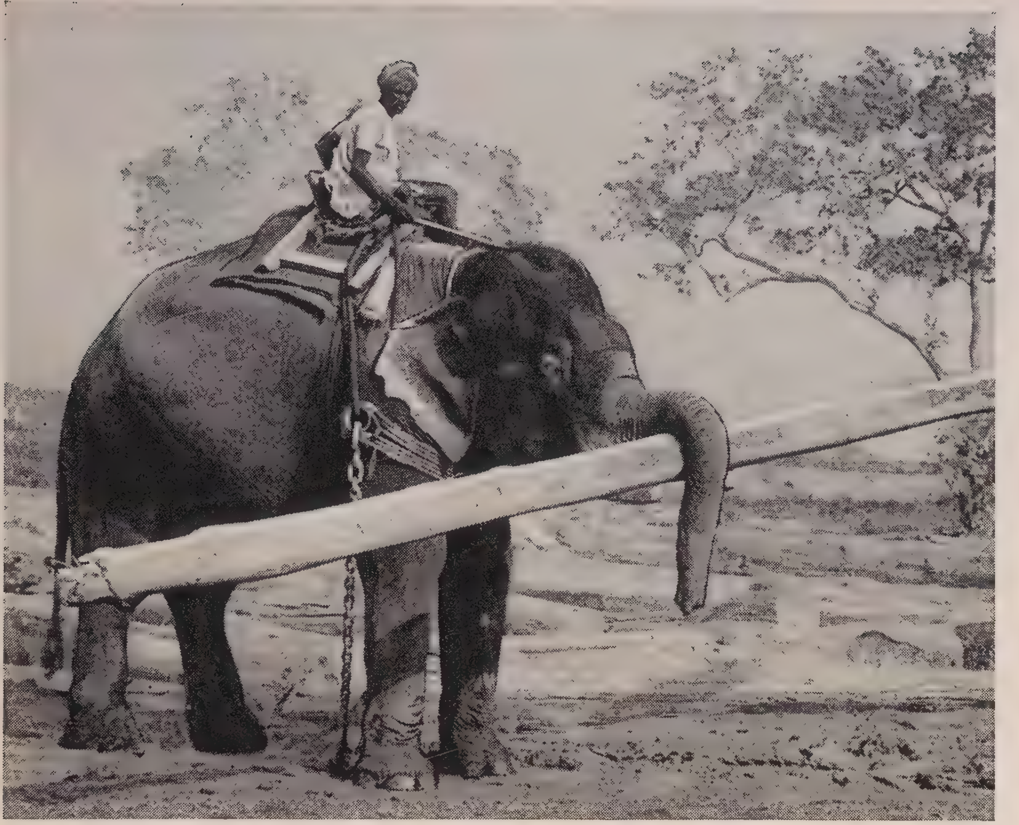
Black tea, which is generally the favorite variety in Europe and America, contains vegetable tannin, caffeine, carbohydrates, and essential oils in minute quantities. Each of these elements contributes something recognizable in a cup of tea. The caffeine provides the stimulating quality; the characteristic pungency or astringency of the tea and its color come from the tannin. An average cup of tea contains about three quarters of a grain of caffeine and about two grains of tannin. The essential oil of tea, which is developed in the curing process, gives black tea its special flavor and aroma.

Tea as a Beverage. Tea is served in different ways in different countries. Australians like it very strong, and they sometimes boil it, as Canadian and Maine lumberjacks do. The English and the Irish also like it strong. In China, the tea may be flavored with jasmine blossoms or other flowers; in Tibet it is mixed with salt and fat. The Russians sometimes add butter and sugar and, occasionally, a little vodka to their tea. In North Africa the favorite mixture is with mint and plenty of sugar. Iced tea originated in the United States and is still almost exclusively American. As a rule Americans use sugar with cream or lemon to flavor hot tea, and sugar and lemon in iced tea. In almost every country, but particularly in the Orient, tea drinking is surrounded with ceremony.

The three rules for making good tea are: (1) always use bubbling, boiling water, and pour it on the tea leaves or tea bag; (2) use one teaspoonful of leaves for each cup, plus one for the pot, for hot tea, and double the amount for iced tea; and (3) steep the brew for three to five minutes.

History. No one knows when tea was first developed. The earliest written records about it are Chinese, and the Chinese were probably the first people to use it as a beverage. The wild plant still grows in southwestern China and the nearby regions. Dutch traders brought tea to Europe from Japan and China early in the seventeenth century, and the East India Company of England began to import it about 1669. It probably reached the American colonies from Holland about 1650. For many years a special spring water was sold in New York streets by peddlers who called "Tea water! Tea water! Come out and get your tea water!" Tea drinking was more and more popular until the argument over taxation without representation made it a symbol of the colonies' opposition to England (see BOSTON TEA PARTY). After the Revolutionary War had been won, tea came back in full favor.

China is the world's largest producer of tea, but consumption of tea is so large in China that exports of Chinese tea are smaller than those of many other countries. Great Britain is the largest importer of tea, with the United States the second largest. United States imports amount to about one hundred million pounds a year, about 80 per cent coming from India, Ceylon, Java, and Su-



Ewing Galloway

CAREFULLY TRAINED ELEPHANTS are essential workers in Burma's teak-logging industry.

matra. All tea that comes into the country is inspected by government examiners who make sure that it meets the standards set up by law.

See also CAFFEINE; MATÉ; TANNIN.

Scientific Name. *Camellia sinensia.*

TEAK, *teek,* a large tropical tree of Asia, is known for the durability of its wood. An oil in the wood not only preserves it from decay but also prevents the rusting of metals in contact with it. Teak, therefore, has long been used in the Orient and elsewhere for shipbuilding. Carved chests and other articles of teak are valued both for their beauty and for the pleasant fragrance of the aromatic teak oil.

The teak tree grows in the inland jungles of India, Thailand, Burma, and neighboring regions. It grows to a height of 100 to 200 feet and has oval leaves a foot or more in length. The leaves are sometimes used for dyeing textiles red or purple. Because green teakwood sinks in water, trees are usually killed while standing and then left for two or three years so that the wood will be dry enough to float down river to the coast. Elephants are often used to drag the logs to the streams, particularly in Burma, the source of much of the teak used in the Western world. The supply of teakwood is inadequate to the demand, and most of the best wood is used in the countries where teak is produced.

TEAL, *teel,* a group of small, swift-flying ducks highly prized as game. The teal, which are surface feeders, are usually found on shallow lakes or marshy ponds. Three species are common in North America. The *green-winged* teal, which is about fifteen inches long, is grayish, with some black and white markings and an iridescent green patch, or speculum, on the hind edge of the wing. The *blue-winged* teal has large blue patches on the front of the wing, and the male has a white crescent in front of the eye. Both species breed in Canada and the northern United States, moving south in winter. Some migrate into the interior of South America. The *cinnamon* teal, a rufous duck with blue shoulder patches, is found in the western part of North America. The female of each species is brownish. See also DUCK.

Scientific Names. Green-winged teal, *Anas carolinensis;* blue-winged, *A. discors;* cinnamon, *A. cyanoptera.*

TEAR GAS is a chemical weapon which irritates the eyes and, for a short period, practically blinds those exposed to it. Tear gases have been used in warfare, but they are more commonly employed by police squads in breaking up riots, routing criminals out of hiding, and meeting other types of emergency. Tear gas may be in either solid or liquid form before it is exposed to the air and may be released by exploding shells or grenades or from small containers carried for personal protection. Persons whose eyes have been affected by the gas weep uncontrollably, cough and choke, and are unable to keep their eyes open. Usually, however, the irritation goes away in a short time, especially if the eyes are washed out with a soothing solution. Chloracetophenone, containing carbon, chlorine, hydrogen, and oxygen, is probably the most common tear gas.

TEASEL, *te′z′l,* a genus of prickly biennial herbs. Its most important species is the *fuller's teasel,* whose bristly flower heads were formerly in general use in the textile industry to raise the nap on cloth. The plant is a biennial native to southern Europe; it has been introduced into North America. It grows about six feet tall and has spiny stems and large, lance-shaped leaves with spiny midribs. Its small, lilac-colored flowers are borne in oblong heads covered with hooked bracts. For use in textile mills, the flower heads, usually three or four inches long, are cut when in bloom, split, and dried. They are then fastened to cylinders which are revolved against the cloth to be napped.

TECHNETIUM, *tek ne′shih um,* the name given to the chemical element of atomic number 43, symbol Tc, because it was the first one produced by technical or artificial means. C. Perrier and E. Segre identified it in 1937 by its radioactivity and its resemblance in chemical behavior to manganese (Mn) and especially to rhenium (Re), the other elements in the same group (VII A) of the periodic table. Technetium is a metal with the same crystal structure as rhenium, osmium, and ruthenium, and it forms several compounds with oxygen. The material first identified had resulted from the transformation of molybdenum (Mo) atoms that had been bombarded in a cyclotron by deuterons, the cores of heavy hydrogen atoms (see ISOTOPES). It is also obtained by bombarding molybdenum with neutrons, but chiefly as a product of the fission of uranium-235 in an atomic pile. All its isotopes are radioactive, and all but one decay and disappear in a very short time. It is most unlikely that the element can exist at all in nature, and the identification of such an element in 1925, then called masurium (Ma), was mistaken. See also PERIODIC TABLE.

TECHNICAL EDUCATION. See INDUSTRIAL ARTS; EDUCATION; VOCATIONAL EDUCATION.

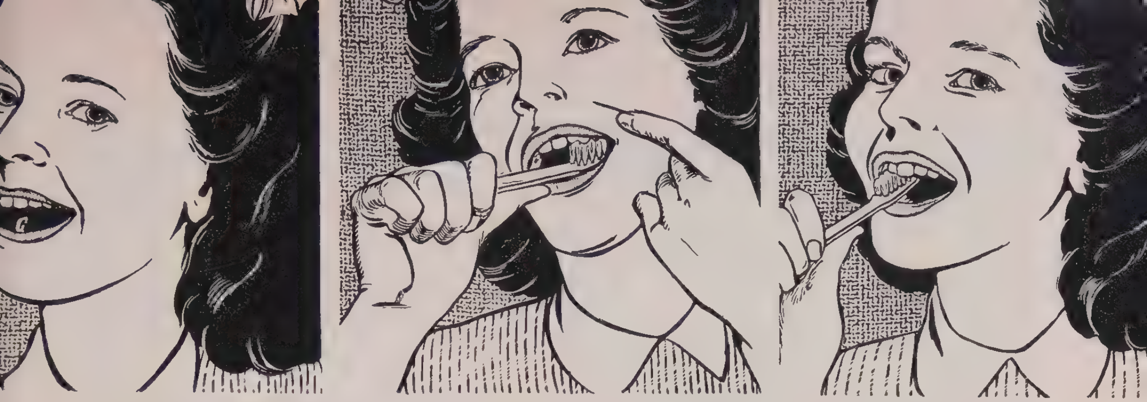
TECH′NICOLOR. See MOVING PICTURES.

TECHNOL′OGY. See INDUSTRIAL REVOLUTION; MACHINE TOOLS AND MACHINING; MASS PRODUCTION; TOOLS.

TECUM′SEH (about 1768-1813), a famous leader of the Shawnee Indians and a man of remarkable intelligence, ability, and vision, grew up in what is now Ohio and Indiana. He soon realized that unless the Indians of the Northwest Territory made a united stand against encroachment, the whites would push them, tribe by tribe, from the lands which had been theirs for generations. By 1808 Tecumseh was determined to unify the Indians and organize them into a strong, well-disciplined confederation. He hoped that with the help of the British he could make the Americans withdraw beyond the Ohio River. Tecumseh was a powerful and gifted political leader, but the confederacy was broken up when his brother, the Prophet, allowed the Indians to be lured into battle prematurely. General William Henry Harrison defeated them completely at Tippecanoe in 1811 (see TIPPECANOE, BATTLE OF). Tecumseh served as a brigadier general with the British forces during the War of 1812 and was killed in the Battle of the Thames River.

TEETH. Probably no other single feature of the human face contributes more to personal appearance than clean, healthy teeth. When teeth are neglected and allowed to decay, they not only detract from one's physical attractiveness but also may influence the entire personality, especially in children. Moreover, defective teeth may interfere with the proper chewing of food or may serve as sources of infection and thus affect general body health. Although the development of naturally sound teeth seems to depend largely on a number of hereditary and environmental factors over which we have little control, good dental care by both the individual and his dentist can do much to ensure healthy, attractive teeth.

Animal Teeth. True teeth occur only in the vertebrate animals and in human beings. Though they have the same general structure, they vary greatly among the different groups of animals and may even be completely lacking, as in birds and turtles. Certain bony fishes bear teeth not only in the jaws but also on the roof of the mouth or in the throat. In species that eat other fish the teeth usually are sharp and pointed for catching and devouring prey, while in mollusk-eating fish the teeth are provided with flattened crowns for crushing shells. Several kinds of fish have teeth that fold backward as food enters the mouth. Certain



IN BRUSHING THE TEETH, the outside surfaces of the upper back teeth, the inside surfaces of the back teeth, and the inside surfaces of the upper front teeth are cleaned in that order.

reptiles, notably the nonpoisonous snakes, have double rows of teeth in each jaw, and poisonous snakes have teeth that are modified into fangs.

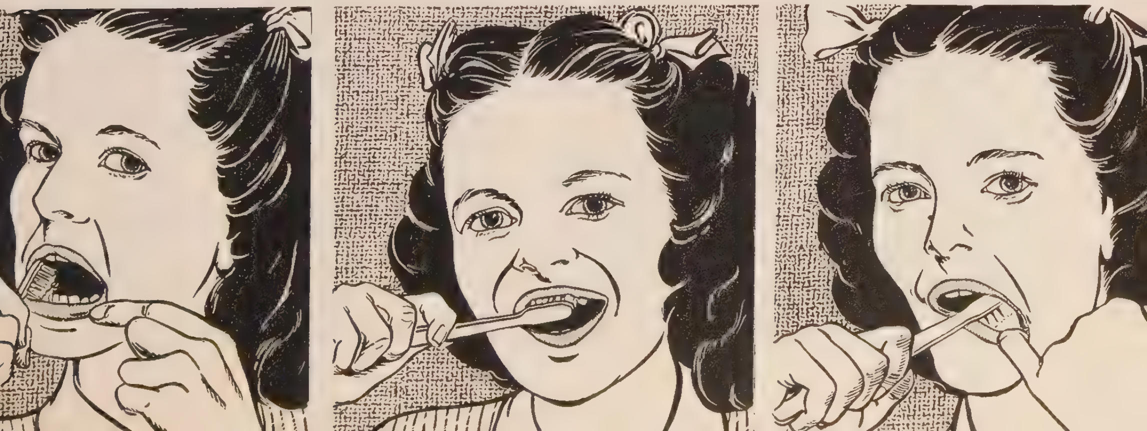
Mammals, though they have fewer teeth than most of the lower vertebrates, show perhaps a wider variety of tooth adaptations. The carnivores, or meat eaters, such as tigers and wolves, have long canine teeth for tearing flesh. Rodents are equipped with large chisel-like incisors for gnawing. These teeth are unusual in that they continue to grow throughout the rodent's life and therefore do not become completely worn down by the animal's gnawing activities. The tusks of elephants are actually elongated incisor teeth. Only one molar tooth in each side of the elephant's jaw is in use at a particular time, and as the tooth wears down, it is replaced by the molar behind it. Many other curious adaptations of teeth are seen among mammals.

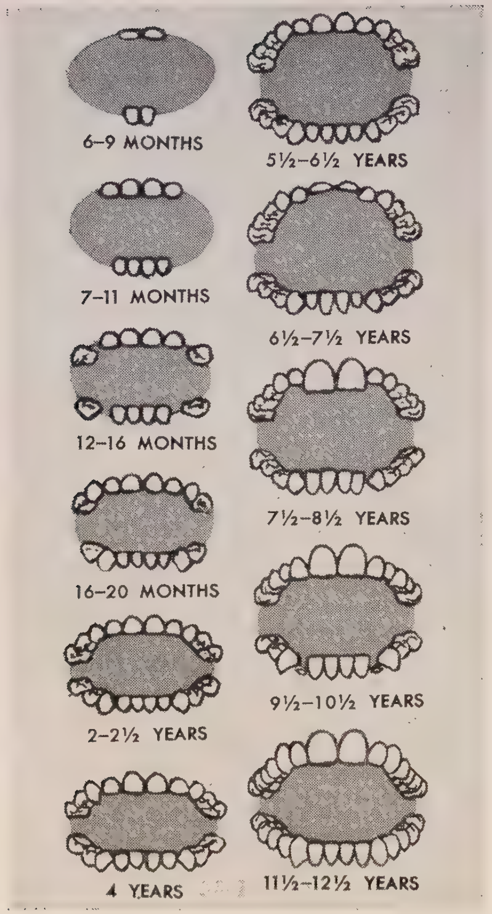
Structure of Human Teeth. The adult human being has a total of thirty-two teeth. Arranged symmetrically in each jaw are four incisors, two cuspids, four bicuspids, and six molars. Each tooth consists of two parts, a crown and a root. The *crown* is covered with enamel and extends beyond the gums. The *root* is encased in a bonelike substance, called *cementum,* and is embedded in the bone beneath the gums. Lining the bony socket in which the root of the tooth rests is a tissue known as the *periodontal membrane;* this tissue helps hold the tooth firmly in the jaw and cushions it against shock. The inner part of the tooth (the part protected by the enamel and cementum) consists of *dentin,* an ivorylike substance perforated by microscopic tubules. Within the dentin is the *pulp,* containing connective tissue, nerves, and blood vessels.

Although they have the same general structure, teeth vary in size and shape, and each kind of tooth serves a special function. The *incisors,* or front teeth, have sharp, flat edges for cutting food. The *cuspids,* or *canines,* also called "eye" and "stomach" teeth, are heavy, pointed teeth used for tearing food. The *bicuspids* have double points, or cusps, on the crown and aid in both tearing and grinding. Molars are large double- or triple-rooted teeth provided with a rough surface for grinding.

Two Sets of Teeth. As in most mammals, the permanent teeth of human beings are preceded by a set of *deciduous,* or *milk,* teeth, which consists of four incisors, two cuspids, two first molars, and two second molars in each jaw — twenty teeth in all. The deciduous teeth begin to develop during the fifth or sixth week of embryonic life. One by one, they originate as soft tooth buds, which grow and form jellylike enamel

NEXT THE OUTSIDE SURFACES of the lower back teeth, the outside surfaces of the front teeth, and the grinding surfaces of the teeth are cleaned.





THE DEVELOPMENT OF A CHILD'S TEETH is shown here, with the approximate age for each of the various stages.

and dentin. Between the fourth and sixth months of fetal development the enamel and dentin begin to calcify (harden), and thereafter growth and calcification of the teeth proceed at a regular pace. Completion of the crown of each tooth occurs from two to eleven months after birth, and then the roots are formed.

The permanent teeth are derived from a second set of tooth buds lying directly above the deciduous teeth. They begin to calcify shortly after birth and continue to grow all during childhood. As the crowns of the permanent teeth enlarge, the roots of the deciduous teeth are absorbed. Since this usually happens before the deciduous teeth are shed, many people wrongly believe that the deciduous teeth lack roots.

The deciduous teeth usually break through the gums at a given time and in a definite order. Some children cut their teeth earlier or later than others, but in most cases, the central incisor teeth of the lower and upper jaws appear when the child is six to nine months old. They are followed by the lateral incisors at seven to eleven months, the first molars at twelve to sixteen months, the cuspids at sixteen to twenty months, and finally the second molars at twenty to thirty months. Between the sixth and eighth years the first permanent molars erupt directly behind the deciduous second molars, and then the central incisors are shed and replaced by the permanent central incisors. The deciduous lateral incisors are replaced by permanent incisors between the seventh and ninth years. The deciduous first and second molars are replaced by the bicuspids between the tenth and twelfth years. The deciduous cuspids are replaced by permanent cuspids between the ninth and twelfth years, and the permanent second molars erupt between the eleventh and thirteenth years. The "wisdom teeth," or third molars, do not appear until the seventeenth to twenty-first years.

Tooth Decay. Practically everyone has suffered from tooth decay at one time or another. In the United States, for example, about 93 per cent of the entire population show signs of such disease. The most prevalent of all diseases, tooth decay attacks persons of all ages, particularly children between the ages of five and eight and adolescents from twelve to eighteen. Apparently, it results from a number of interacting forces rather than from a single agent. Though all of these forces are not wholly understood, a great deal is known about the mechanism by which teeth become decayed.

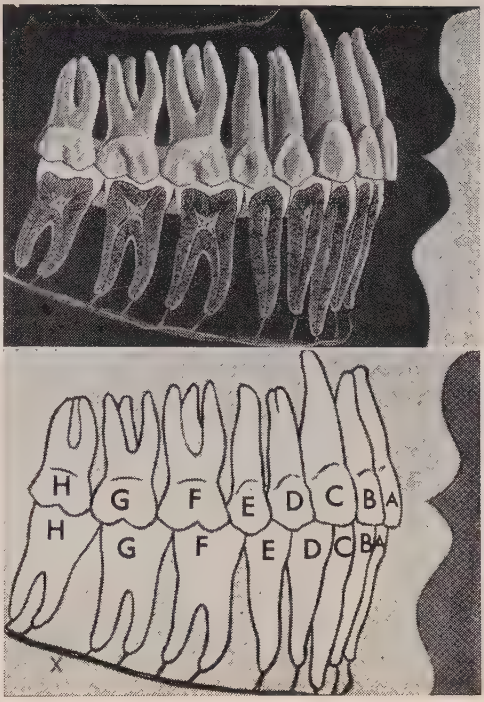
Decay begins most often in the pits and grooves of the teeth, at the gum line, and in those areas where the teeth are in close contact with one another. Certain bacteria invade these areas and act on the starches and sugars contained in food, producing an acid which causes the enamel to dissolve and *caries,* or *cavities,* to form in the teeth. As the decay penetrates deeper and deeper, the dentin also begins to dissolve. Sometimes, this process progresses so rapidly that almost all the dentin of the crown is eaten away, leaving a shell of enamel that collapses when subjected to even the slightest pressure. If caries are neglected, the decay finally invades the pulp, destroying the nerves and causing the death of the pulp. The infection may also spread down through the root and form an abscess, cyst, or spreading infection in the bone.

The problem of caries prevention has been the subject of intensive experimentation for many years. Investigators have found that restricting the intake of sweets, coating children's teeth with sodium fluoride, adding fluorides to community drinking water, and brushing the teeth immediately after eating will help cut down tooth decay. Such methods, however, are not cure-alls, and the best way of preventing advanced dental trouble is to visit a dentist regularly. With the aid of X-rays, the dentist can detect and remedy caries and other tooth disturbances, which might lead to serious difficulties if neglected.

Abnormalities and Diseases. The type of dental abnormality most often encountered is *malocclusion,* or abnormal contact of the upper and lower teeth. Three general kinds of malocclusions have been identified: (1) those in which only the teeth themselves are out of line, resulting in crooked or crowded teeth; (2) those in which the lower jaw bone is thrust backward, causing a weak chin and buck teeth; and (3) those in which the lower jaw bone is thrust forward, causing an underslung jaw. Malocclusions range from slight irregularities to deformities extreme enough to render the teeth completely useless for chewing food. Other fairly common dental abnormalities include the inability of a tooth to erupt because of its irregular position (*impaction*), a congenital lack of one or more teeth, the presence of extra teeth, and the eruption of teeth into the wrong position, such as molars in place of incisors.

Several diseases may attack the tissues that surround the teeth and hence affect the teeth themselves. *Gingivitis* is a condition in which the part of the gum surrounding the neck of the tooth becomes inflamed and bleeds easily. If severe enough and left untreated, gingivitis may lead to a more serious disease called *periodontoclasia,* or *pyorrhea.* In pyorrhea the periodontal membrane becomes infected and pus-filled food pockets form about the teeth. Gradually the bone itself begins to dissolve so that the teeth become loose and perhaps fall out. Stomatitis, trench mouth, cheilitis, and canker sores are other common disorders of the mouth. See MOUTH; PYORRHEA.

Care of the Teeth. Children should be taken to the dentist when all of the deciduous teeth have erupted — sometime between the ages of two and three years. At this time the child should also be taught to brush his teeth properly. The dentist will examine the child's teeth, taking X-rays if necessary, and clean the teeth and fill any cavities that may be present. He will probably inform the parents of the necessity of regular dental examinations for their children. The care of deciduous teeth is important not only to maintain good general health but also to ensure healthy, attractive permanent teeth. When a deciduous tooth is lost too soon, the other teeth may shift about, closing the spaces through which the permanent teeth should erupt and in this way causing the permanent teeth to come in crooked. This may be prevented, however, by fitting into the empty space a device known as a *space maintainer.*



FROM FRONT TO BACK the teeth of an adult are the central (A) and the lateral (B) incisors; the cuspids (C); the first (D) and second (E) bicuspids; and the first (F), second (G), and third (H) molars. Below are the artery, vein, and nerve (X). The internal structure of the lower teeth is shown.

Permanent teeth also require regular inspection by the dentist. Cavities should be filled as soon as possible, and the teeth polished and freed of tartar. *Calculus,* or *tartar,* is a substance contained in the saliva. When it is first deposited on the teeth, it is soft and waxy, but it soon hardens, forming stony deposits which may irritate the gums. Any permanent tooth that is extracted should be replaced to prevent nearby teeth from drifting out of line and placing added stress on other teeth; such stress may injure the gums and bone. Malocclusions should also be corrected, but these corrections usually are made by a special kind of dentist, an *orthodontist,* who may be recommended by the regular dentist. The age at which to begin straightening the teeth is decided by the orthodontist.

Dental Work. When caries form, the decayed portion of the tooth must be drilled out and filled with a suitable material. Temporary fillings, such as gutta percha or cement, are meant to last only for short periods and should be replaced with permanent fillings. Among the most widely used permanent fillings are amalgam, foil, porcelain, and in-

INCISORS

CUTTING

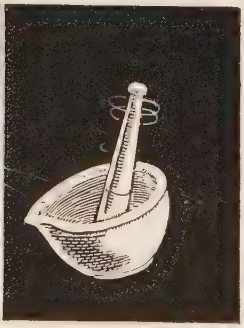
CUSPID

TEARING

BICUSPIDS

CRUSHING

MOLARS



GRINDING

lay. The best known is the *amalgam,* or *silver,* filling, which is made by mixing silver with zinc, tin, or copper and uniting this compound with mercury. Because of its color it is used only in the back teeth. The *foil* filling consists of gold pellets that have been hammered into the cavity one by one to form a solid mass. Though superior to amalgam in many ways, it is far more difficult to insert. The *porcelain,* or *enamel,* filling is made of cement and can be matched with the natural color of the patient's tooth. For this reason it is the preferred filling for the front teeth. The *gold inlay* is constructed from a wax impression of the cavity and is then cemented into the cavity. When properly made, it supplies an excellent, almost indestructible filling for large cavities in the back of the mouth. Porcelain and enamel inlays, though not as durable as gold, are sometimes used in the front teeth.

The branch of dentistry concerned with the replacement of lost or defective teeth is called prosthetic dentistry. As long as the roots are healthy, individual teeth that are unsightly or badly decayed may be restored by capping with artificial crowns. In preparing the *porcelain-jacket* crown the enamel is removed from the tooth and a porcelain cap is fitted over the remaining dentin. Similar crowns may be made of gold, plastic, or gold with a veneer of porcelain. Another type of crown is made by grinding down the tooth to the gumline and enlarging the root canal; a porcelain crown is then attached by means of a dowel, or pin, which fits into the root canal. Also known as a pivot tooth, this crown is apt to drop out rather easily and therefore is not favored by most dentists.

Extracted teeth may be replaced with bridgework or dentures. In bridges the artificial teeth are supported by sound natural teeth at each end of the bridge. The various types of bridges may be either stationary or removable, but all should be constructed in such a way that food cannot collect and decay about them. *Partial dentures* are similar to removable bridges. In partial dentures, however, the artificial teeth are supported mainly by the palate and gums and the denture is held in place with clasps or other attachments. In addition, the partial denture can be used for the replacement of many teeth rather than for just one or two.

When all of the teeth in either the upper or lower jaw are missing, full dentures are required. Formerly made of rubber, they are now composed of plastic and when properly constructed closely resemble natural teeth. Dentures should be cleaned after every meal and at regular intervals should be checked by the dentist for proper fit. As is true with all dental work, their cost is determined not so much by the type of materials used in them as by the amount of labor required to make them. See also DENTISTRY.

TEGNER, *teng nayr′*, ESAIAS (1782-1846), a Swedish poet whose works were both religious and patriotic. He was born in Kyrkerud, in the province of Värmland, graduated from the University of Lund, and taught Greek there from 1810 to 1824. From 1824 until his death he was Bishop of Vexiö. His last years were darkened by mental and physical illness. Tegnér did much to revive interest in the rich heritage of early Scandinavian literature as it was preserved in the sagas of ancient Iceland. His greatest contribution to the literature of his people was *Frithjofs Saga* (1820-25), a poetic rendering of an early Icelandic epic. This and *The Children of the Lord's Supper* were translated into English by Longfellow.

TEGUCIGALPA, *teh goo sih gal′puh,* the capital of Honduras. See HONDURAS.

TEHRAN, *teh hrahn′,* IRAN, the capital and largest city of the country, is situated seventy miles south of the Caspian Sea in an irrigated plateau region at the southern slope of the snow-capped Elburz Mountains. Parts of the city have been modernized according to the best European standards, but large sections still belong to the ancient East. The principal buildings are the royal palace, the government buildings, and the royal museum, which houses the crown jewels and other treasures, some of great antiquity. Tehran is a trading and industrial center; highways and trade routes connect it with all important Iranian cities, and a railroad line joins it to Bandar Shah on the Caspian Sea and Bandar Shahpur on the Persian Gulf. It has a university and a Presbyterian mission school. The city was founded in the twelfth century but did not become the capital until 1788. The Tehran Conference of 1943, which brought together Roosevelt, Churchill, and Stalin, was one of the chief conferences of World War II. The population of the city and suburbs is about 700,000.

TELAU′TOGRAPH, an instrument for transmitting writing or drawing in facsimile by means of electricity, patented in 1888 by its inventor, Elisha Gray. It consists of a transmitter and a receiving apparatus connected by wires. The writing is done with a stylus connected by two arms, or levers, to regulators, or rheostats; these regulators vary the current transmitted, in accordance with changes in the movement of the stylus. At the receiving end, electromagnets and coils turn the electrical impulses back into mechanical motion, causing a stylus to reproduce instantaneously the message or drawing being sent. The device is extensively employed in railroad stations, department stores, industrial plants, government offices, and banks to transmit written orders and instructions from one department to another. In banks the telautograph provides a means of transmitting signatures without delay.

TEL AVIV, *tel uh veev′*. See JAFFA-TEL AVIV.

TEL′EGRAM, a message sent by telegraph. Telegraph companies charge for sending messages according to the length of the message, the distance it is sent, and type of service. Most expensive is the full-rate telegram, which is given the fastest service. The day letter, over which the full-rate telegram has preference, and the night letter, which is delivered the morning after the message leaves the sender, are cheaper. Special rates are given for a series of telegrams sent from one person to another on the same day. Telegrams sent from one country to another may be in words or in code.

Telegraph companies offer special ready-made messages to be sent at Christmas, on Mother's Day, and on other holidays. "Singing telegrams," usually containing birthday greetings, are messages sung to the recipient by the delivery boy. Telegrams reach their destinations more quickly than letters and, unlike telephone calls, provide a permanent record of the communication.

TELEGRAPH, *tel′eh graf,* a method of communicating between two points by means of electrical impulses. The first successful magnetic telegraph was built by the American Samuel F. B. Morse in the winter of 1835-36, and on May 24, 1844, the inventor sent the famous message "What hath God wrought!" over the first telegraph line, between Baltimore and Washington, D. C. Today telegraph lines connect thousands of communities and, in the form of submarine cables, cross oceans and join continents. Hundreds of millions of telegrams are sent each year. In those nations of the world where vast distances made communication difficult, the speed and ease of telegraphic transmission developed unity, encouraged settlement, and stimulated economic growth. Like the radio, the airplane, and other major inventions of the machine age, the telegraph has broken down barriers of space and time the world over.

Basic Telegraphy. The essential parts of the telegraph are a battery or other source of electric current, a line wire or other conductor for conveying the current from one station to another, a sending apparatus, and a receiving apparatus. The stations may be connected by radio beam, by wires supported on poles, or by underground cables. The wire, originally of iron but now of nonrusting copper, is grounded, and therefore no second wire is needed to complete the circuit. In the early days of telegraphy, the circuit was closed when a key, or transmitting lever, was pressed down. A current was sent through the wire to the sounder, or receiving apparatus, where it magnetized an electromagnet; and this electromagnet caused a lever to strike against a metallic point with a sharp click. When the transmitting key at the sending station was lifted, the circuit was broken, and the spring in the sounder brought the lever back to its original position.

Where the distance between stations is so great that the normal current is not strong enough to carry the message successfully, relays, or *repeaters,* serve to boost it along the line. These relays are very sensitive electromagnets which react to feeble current and send the messages on with renewed power.

Mechanical Improvements. Morse telegraph, which was originally used, consisted of sending long and short electrical impulses, known as dots and dashes, in a code that represented the letters of the alphabet. The dots and dashes were recorded at their destination on a moving paper tape, but in the United States operators soon learned to receive the code by ear and came to prefer this method.

Since the beginning of the twentieth century, Morse telegraphy has been gradually replaced by various facsimile and automatic-printing telegraph methods. Whereas in 1910 nearly 90 per cent of America's telegraph business was handled by Morse code, today nearly all telegrams are transmitted and received by automatic machines.

The *multiplex system,* introduced in 1915, is an automatic method which permits the transmission of as many as eight messages (four in each direction) simultaneously at high speed over one wire. The messages are typed by operators on keyboards similar to those of typewriters. As the keys are struck, holes in combinations representing letters and other characters are punched in a moving paper tape. The tape passes into a transmitter, and electrical impulses created as pins slip into the holes flash out over the wire. Upon reaching the multiplex printer at the other end, the impulses are electrically translated back into characters and printed on a telegraph blank or on tape which an operator gums to a blank. The multiplex system is used on lines connecting major centers, where sending and receiving activity is heavy and continuous.

The *teleprinter,* or *teletypewriter,* was developed in the 1920's for use on short circuits where traffic is light; it sends signals directly from a keyboard to a printer at the receiving end. Teleprinters in branch telegraph offices and in customers' offices are connected with similar machines in the main telegraph center, and messages are sent back and forth, making deliveries between points almost instantaneous.

The establishment of high-speed *message centers* has doubled the capacity of telegraph systems and increased the speed and efficiency of telegraph service. At one time messages received at a telegraph center were sorted by routing clerks and then carried by girls on roller skates to operators, who retransmitted the telegrams to their destinations. Now a message typed at the point of origin is received at the center in the form of perforated tape and is flashed to its destination without manual retransmission at any point.

Frequency-modulation carrier systems increase the capacity of telegraph trunk lines. Carrier equipment superimposes a number of different frequencies on a single pair of wires, and several operators may send and receive messages on each frequency. It is possible for as many as 288 operators to send and receive over the two wires at the same time.

The *radio-beam system,* a modern type of wireless telegraphy, does away with pole lines and the related troubles caused by ice, high winds, and falling trees. Radio towers thirty to fifty miles apart redirect super-high-frequency waves, which travel in a straight line like television beams. Antennas transmit the signals in a narrow beam from tower to tower, and unattended repeater stations located at the towers automatically and instantaneously send the radio-telegraph signals on their way. Since atmospheric static is not a problem in the microwave region, radio-beam transmission is unaffected by electrical disturbances. Thousands of messages can be carried simultaneously.

Telefax machines permit the fully automatic transmission of facsimiles by a telephotographic process. A message, drawing, or photograph is dropped into the machine, where it is scanned by an electric eye as it turns on a revolving cylinder. The electric eye transmits directly over the wire or radio beam a series of electrical impulses representative of the light and dark portions of the message or illustration. A similar cylinder in the receiving machine, equipped with electro-sensitive paper, records an accurate reproduction, ready for immediate delivery. Telefax operation is used for the transmission of messages between branch and main offices of telegraph companies and between the offices of large business firms and main telegraph offices. Telefax machines are used by airlines, railroads, and shipping companies and in some localities are set up for public use.

Desk-fax, a small facsimile machine installed on a desk in a business office, both sends and receives messages. Its operation is simple: the telegram, either typed or handwritten, is wrapped around a metal cylinder; the sender presses a button, starting the transmission; and an electronic eye sends the message automatically to the receiving machine, which reproduces it in exact facsimile. Messages may be received in a similar manner. This type of telegram transmission eliminates messenger pickup and delivery.

Private-wire systems are leased by the telegraph company to private industries and organizations and to the government. The United States Air Force stations, many large banks, and the scattered plants and offices of numerous corporations are linked by private-wire systems. Other services include ticker systems from stock and commodity exchanges, reports on shipping activity, and news of sports events. Money orders can be transmitted by telegraph.

Wireless, or Radio, Telegraphy. The use of radio waves instead of wire to carry telegraph messages was developed from the experiments of the Italian, Guglielmo Marconi, who was able to send a signal across the Atlantic Ocean by this means in 1901. Overseas radiotelegraph circuits are widely used today, as is ship-to-shore radiotelegraphy. Radiotelephones permit the sending of telegrams to and from persons on trains and in automobiles; a call is made to a telegraph office, which sends the message (see TELEPHONE, *Radiotelephone Transmission*).

History. Numerous attempts to invent an electric telegraph were made before Morse devised his system, and a telegraph invented by the Englishmen Sir William Cooke and Sir Charles Wheatstone was patented in 1837, three years before Morse received his patent. Morse's success depended to a considerable extent upon the improved electromagnet produced by his fellow American, Joseph Henry. Although Morse patented his system in 1840, he was forced to wait three years before Congress appropriated the funds to construct the experimental line over which the famous first message was finally sent in 1844.

Seven years later the dispatching of trains by telegraph was begun in the United States, and in the same year the great telegraph company now known as Western Union was launched. In 1861 Western Union constructed the first telegraph line across the continent, thereby contributing to the growth and unity of the nation. Today the United States owns about one third of the millions of miles of telegraph line which crisscross the globe. Submarine cables carry telegraph messages across both the Atlantic and the Pacific oceans. See also CABLE, SUBMARINE.

TELEMACHUS, *teh lem'uh kus.* See MENTOR; ULYSSES.

TELEPATHY, *teh lep'uh thih,* communication between one person and another by thought transference. Almost everyone has had experiences suggesting that thoughts can be conveyed directly from one mind to another, but scientific tests have neither proved nor disproved the possibility of such communication.

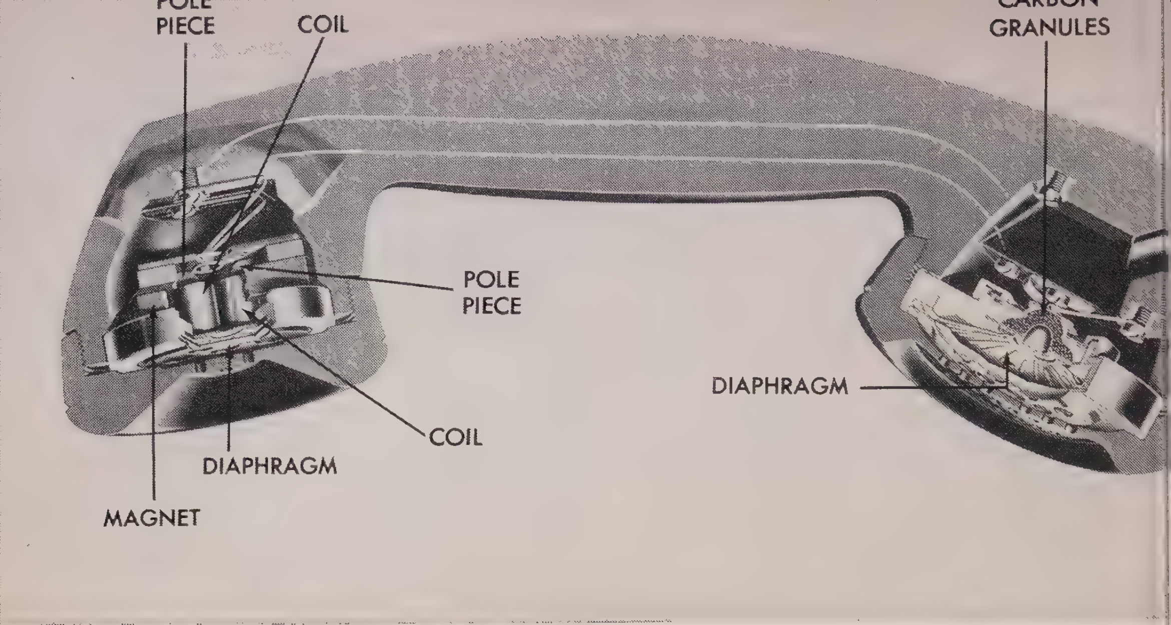
TELEPHONE. The basic telephone instrument was invented by the Scottish-American scientist, Alexander Graham Bell, in 1876. Since then, as with nearly all great inventions, improvements have been made by many people. The scope and usefulness of the telephone have been extended until today it is possible to talk by telephone to persons in almost any corner of the world.

The Telephone Transmitter. When a person speaks into the mouthpiece of the telephone transmitter, the sound waves produced by his voice strike against a thin metal diaphragm, or disk, causing it to vibrate backward and forward. Attached to the back of the disk is a chamber loosely filled with granules of carbon. When the instrument, or the receiver, is raised from its cradle, an electric current is sent through the carbon chamber by a battery or other source of direct current. As the disk vibrates back and forth, the carbon granules are alternately pressed more closely and less closely together. When the granules are close together, the electric current flows more easily through the circuit; and since the electrical resistance is less when the granules are compact, the flow of current is increased.

For every sound wave that strikes the diaphragm, an electric wave is set up in the circuit. This circuit, which flows through a wire to a receiver at the other end of the line, changes in strength as many times per second as do the sound waves that strike the diaphragm. Such a current is called a fluctuating or pulsating current. The purpose of the transmitter is to change the mechanical energy of the sound waves into electrical impulses. Sound itself is not sent through the wires.

The Telephone Receiver. The electrical impulses are changed back into speech sounds in the receiver, which contains two sets of magnets. At each pole of the magnet is a coil of insulated wire, and near to, but not touching, the poles is a thin, iron diaphragm. The fluctuating current from the transmitter, as it flows through the coils of the receiver, produces changes in the magnetic strength of the magnet's poles, causing the diaphragm to vibrate back and forth in exact accordance with the sound waves that produced the impulses in the transmitter. This vibration sets up new sound waves which closely match in pitch and quality those of the original waves. It is in this indirect manner that the person called hears the voice of the caller.

The Telephone Circuit. Every telephone is connected by wires to a central office, which contains switchboards and other equipment. In a manual office, where operations are carried out by hand instead of



THE COMPACT, STREAMLINED TELEPHONE HANDSET, made up of dozens of tiny parts, is the sensitive tool which enables us to speak with one another when we are thousands of miles apart.

electrically, operators are employed to complete connections between callers and persons called. A switchboard contains a large number of holes, or *jacks,* which are arranged in numerical order on panels within reach of each operator.

The operator's head-set of earphones and mouthpiece leave her hands free to handle cords and listening keys, or switches, which are arranged on a shelf before her. She can connect her head-set to any one of the cords by moving a listening key and holding it in the "on" position. The ends of the cords are fitted with plugs which fit in the jacks. When a call is made, a small light just above the jack of the caller's line goes on. The operator plugs one of a pair of cords into the jack, moves the key which connects the cord to her head-set, and says, "Number, please." Receiving the number of the person called, she plugs the other cord into the jack of the telephone with that number and sends a ringing current down the line to summon the other person to his telephone. A signal light close to the connecting cord goes on when the connection is completed. It stays lighted until the person being called answers his telephone. In this way the operator knows whether or not the call has gone through. When the conversation is completed and both speakers hang up, the light goes on again and remains on until the plug is removed.

In large cities more than one central office is needed to house the switchboards and other equipment required for efficient service. The lines connecting the different central offices are called *trunk lines.* When a call is made to one whose telephone lines terminate at a different central office from that of the caller, the operator finds a trunk line that is not in use and plugs into its jack; she then relays the telephone number to the operator at the other station, who makes the connection with the telephone of the person being called.

In many large business offices and establishments, switchboards are installed by the telephone company to provide service for all the telephones on the premises. A call made to such an office is received by an operator who completes the connection. The office switchboard also handles calls from one person to another within the organization and, by means of trunk lines to the nearest central exchange, to persons on the outside.

The Dial Telephone. What the operator does by hand in a manual office is done by machinery when a call originates from a dial phone. The parts of the complex electrical equipment involved quickly and accurately follow the instructions sent to them when the dial is operated.

The dial phone usually has a dial bordered with circular openings, each of which is labeled with a number from 1 to 0, and with letters of the alphabet. A person making a call inserts a finger in the opening marked with the first letter or number of the phone he is calling and rotates the dial clockwise until it comes to a stop. As the dial is released, a spring brings it back to its original position.

Connected to the dial is a toothed cam. As the dial moves back to its original position, the cam interrupts the steady flow of electrical current the same number of times as the number dialed. These breaks of the current, or impulses, are transmitted along the wire to the control office, where they operate electromagnetic relays, switches, and other electrical equipment. As the complete series of letters and numbers is dialed, the electrical impulses choose the proper route to the central office, pick out the line being called, and connect it with the phone making the call. When the connection is completed, a bell is rung automatically in the place being called.

When a call is made from a dial phone to a manual phone, the dialed number shows up on a ground glass screen at the central office, and an operator completes the call. In another method of completing such calls, the electrical impulses produced by dialing cause the number to be spoken automatically into an operator's ear. The operator then completes the connection by dialing.

Telephone Lines. The United States has considerably more than half of all the telephones in the world — a total exceeding seventy million. The forty-four million American phones are interconnected by millions of miles of wire. A home telephone is connected with a central office by a wire called a *drop wire,* running to a nearby pole; here it is connected with a pair of copper wires that run from pole to pole. Where many lines follow the same route, a number of pairs of copper wires are made to branch out from a small distribution cable, in which a bundle of these wires is enclosed in a waterproof covering. The distribution cable runs from pole to pole to a point where it branches out from a much larger feeder cable. This cable may be carried on poles, but, in cities especially, it is more likely to lead back to the central office by underground conduit.

Trunk cables leading from city to city or connecting central offices are also carried in conduits, some of which run beneath rivers and bays. A single cable may contain more than two thousand pairs of fine copper wires. Well over half of all the telephone lines in the United States are carried in underground cables.

Long-Distance Telephony. Separate switchboards are used for carrying long-distance calls. Connected to the long-distance switchboard in each city are direct lines to other cities. If a call is put in to a place to which there is no direct line, the operator arranges a line by calling an intermediate point and asking the operator there to complete the connection. Teletypewriter networks connecting toll centers keep operators informed of bottlenecks and contribute to efficient service.

Long-distance operators can dial calls directly through to telephones in certain distant cities. The caller dials the long-distance operator, and local dial equipment switches the call to a toll office. Here the long-distance operator can send the call to the distant city, where the connection with the person being called is completed automatically by dial-switching equipment.

Numerous improvements and new developments have made possible the extension of telephone service over even longer distances. In the past it was not possible to transmit speech more than a few hundred miles, and even in shorter lines reception was often indistinct. But reception has been improved and the distance of transmission increased by the insertion of coils of wire, called *loading coils,* at definite places along the line to conserve the power of the current. Other major improvements have involved the vacuum-tube repeater station, the use of so-called carrier currents, radio-relay, and coaxial-cable systems.

Vacuum-tube amplifiers, similar to those used in radio, reinforce the current in long telephone lines and make it possible to send many different messages at the same time over a single pair of wires. Each station sending out messages uses its own high-frequency *carrier current,* and each current has a different frequency. The currents are amplified along the route and are sorted out at the receiving end by other vacuum tubes. Radio relay uses very short microwaves, which are beamed from one relay station to the next. Since the microwaves move in a straight line, the signal is lost unless the stations are fairly close to each other — usually about twenty-five or thirty miles apart. Both telephone messages and television programs are carried by the interference-free, superhigh frequencies used in radio relay.

The *coaxial cable* is a telephone pipe line in which pipes, called coaxials, are employed. A single coaxial unit consists of a copper tube about the size of a little finger. Down the center of each tube runs a single copper wire a little thicker than a pencil lead. The wire is held in place by small disks of insulating material. The cable is called a coaxial cable because the copper wire and the copper tube have the same axis. Most coaxial cables contain eight tubes, which can transmit simultaneously electrical impulses having a wide variation of frequencies.

The electrical waves carried by the tubes flow directly to a point of destination instead of spreading in all directions like radio waves. Two coaxial units with the necessary number of amplifiers make up a coaxial line. As many as six hundred separate telephone conversations may be carried simultaneously over the same line. At the receiving end, crystal filters separate out the individual conversations. Coaxial cables are also the main arteries of television networks.

Radiotelephony. Radio connects a number of telephone services separated by oceans. Voices are sent by wire to radio transmitting stations, which beam them overseas. Receiving stations put the voices on telephone wires. Telephone conversations with persons on ships, trains, and in automobiles and other vehicles are also carried on by radiotelephony.

Atlantic Cables. Two cables extending under the Atlantic carry telephone conversations between North America and Europe. One carries messages eastward, the other westward. Each can carry thirty-six messages at the same time. Seven of the circuits extend to Paris, Amsterdam, Frankfort, Brussels, Copenhagen, and Berne. The main cable extends from Sidney Mines, Nova Scotia, to Clarenville, Newfoundland, to Oban, Scotland. United States phones connect with it by radio between Portland, Me., and Sidney Mines.

Telephotography. Another extension of telephone service is the flashing of pictures over long distances by a telephotographic process. One method employs two cylinders rotating at the same speed. One cylinder is set up at the transmitting station, the other at the receiving station. The picture to be transmitted is wrapped around the cylinder at the transmitting station. As the picture rotates, it is scanned by a fine beam of white light. Some of the light is reflected by the picture to a photoelectric cell, setting up an electric current, the strength of which varies with the intensity of the light reflected. The current, greatly amplified, is transmitted by telephone wire to various receiving stations, where a beam of white light strikes a photographic film or paper wrapped around the rotating cylinder. The beam acts through a valve which admits the light in proportion to the intensity of the current received from the photoelectric cell.

See also BELL, ALEXANDER GRAHAM.

Books for Reading and Reference

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WIDDEMER, MABEL CLELAND. *Aleck Bell, an Ingenious Boy.*

TELEPHOTOGRAPHY. See TELEGRAPH; TELEPHONE.

TELEPRINTER, or **TELETYPEWRITER.** See TELEGRAPH.

TEL'ESCOPE, an instrument for seeing distant objects, particularly the heavenly bodies. A telescope consists of a lens or a mirror that gathers the light of an object such as a star or a planet and brings it to a focus, where it can be magnified by the use of another lens called the eyepiece.

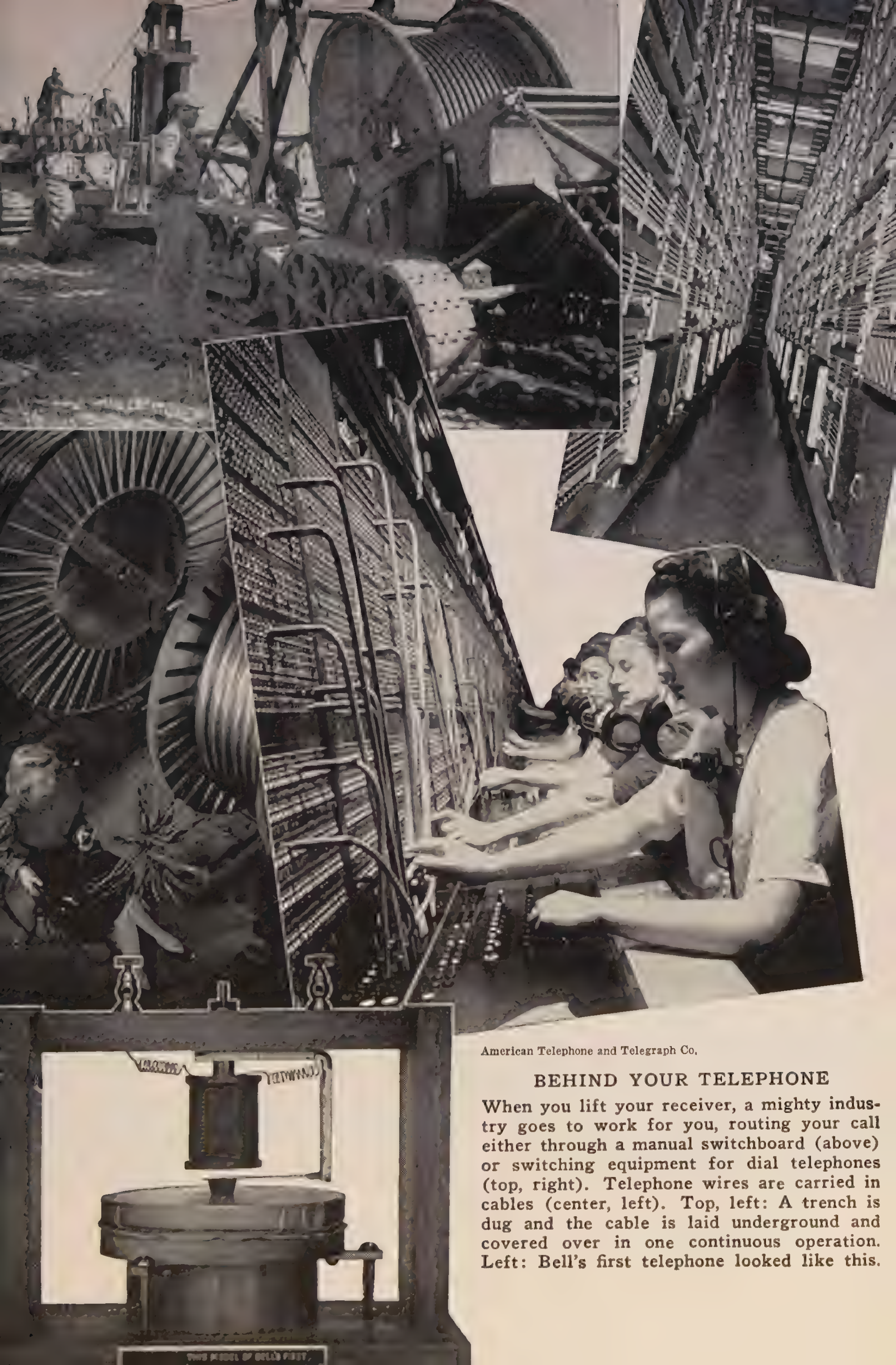
Basic Types of Telescopes. There are two basic types of telescope — the refracting and the reflecting. A *refracting* telescope is a closed tube with a large lens, called the object glass or objective, at one end and a smaller lens, or eyepiece, at the other. Light passing through the object glass is collected and concentrated at the focal point, or focus, near the opposite end of the tube. The image produced near this point may be enlarged by the second lens, through which the observer looks. If the telescope is being used as a camera, the photographic plate takes the place of the eyepiece, and the image is recorded on the plate.

In a *reflecting* telescope the objective is a concave mirror made with a glass base and a coating of silver or aluminum on the upper surface. Before it is coated, the glass is ground in a curved shape, so that all light falling on it will be reflected back to a given point or focus. This figuring of the mirror is done with the greatest precision; it must be exact to within a few millionths of an inch. The finished mirror is placed at the bottom of an open, tubelike frame. Light that strikes it is reflected in the direction from which it came. Usually a second, small mirror, placed in the middle of the tube, toward the top, catches the light and directs it into an eyepiece on the side of the telescope. The observer, perched on a movable stepladder, works near the upper end of the telescope.

There are, however, a good many possible ways of placing extra mirrors so that the light is finally brought to an eyepiece near the bottom of the tube or even below the objective. The great 200-inch Hale reflector of the Mount Palomar Observatory, the largest reflecting telescope yet constructed, was cast with a hole in the center of the disk. The light falling on the huge mirror is reflected into a small, slightly curved mirror set across its path in the middle of the tube, and from this it is reflected through the hole in the center of the objective to the eyepiece. With this arrangement, the observer is placed at the lower end of the telescope, as he is when he is using a refractor.

The 200-inch reflector is so large that it is also possible to have the observer swung up in a sort of cage into the middle of the tube, near the point where the light from the mirror comes to a focus. This arrangement does away with the need for extra mirrors. The cage cuts off some light from the great mirror, but the amount of loss is not great in comparison with the size of the mirror.

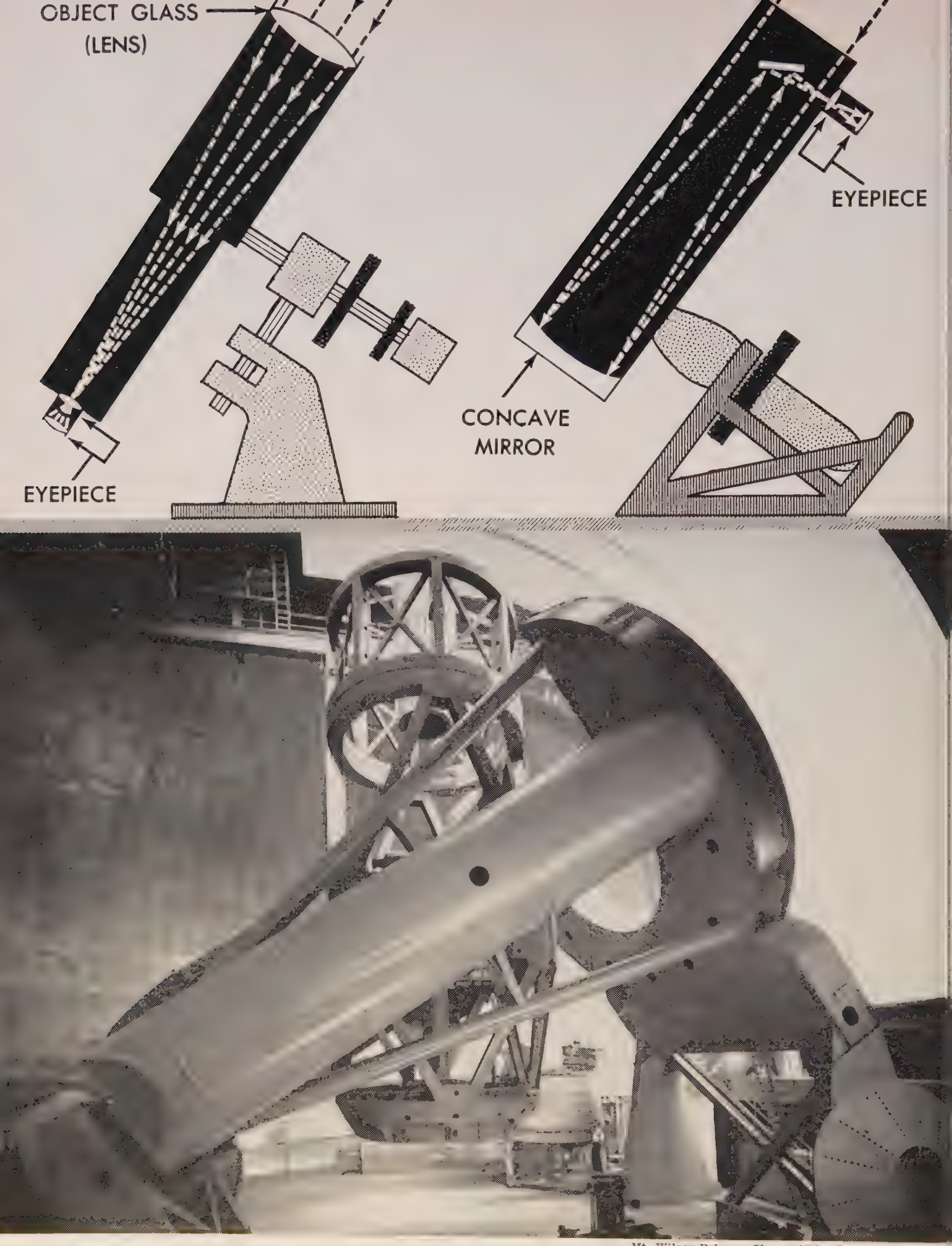
Light-gathering Power of a Telescope. The main job of the lens or mirror in a tele-



American Telephone and Telegraph Co.

BEHIND YOUR TELEPHONE

When you lift your receiver, a mighty industry goes to work for you, routing your call either through a manual switchboard (above) or switching equipment for dial telephones (top, right). Telephone wires are carried in cables (center, left). Top, left: A trench is dug and the cable is laid underground and covered over in one continuous operation. Left: Bell's first telephone looked like this.



Mt. Wilson-Palomar Observatories Photo

RAYS OF LIGHT PASSING THROUGH THE LENS converge near the eyepiece of the refracting telescope (top left). In the reflecting telescope (top right) light is directed to the eyepiece by two mirrors. Suspended on its massive mounting, the giant Hale reflector at the Palomar Observatory (bottom) sometimes carries an astronomer in its upper tube, where the mirror at the base focuses the light.

scope is to collect light. The larger the lens or mirror, the more light it gathers and the brighter the image it produces. The world's largest refracting telescope, at the Yerkes Observatory, has a lens forty inches in diameter; the pupil of an eye is about one fourth of an inch in diameter when it is dilated. The light-gathering power of the big lens is therefore 25,600 times as great as that of the unaided eye. The 200-inch mirror collects 640,000 times as much light as the human eye. This means that objects 1/640,000 as bright as the faintest stars visible to the naked eye can be recorded by the great mirror. It reaches far into the depths of remote space.

The Image. A perfect lens or mirror produces a *sharp* image. It is the distance between the objective and the image it makes that determines the *size* of the image; a very long telescope is necessary if the image is to be large. The eyepiece magnifies the image, and a bright, sharp image can be magnified more than a faint one, just as a sharp, clear photograph can be enlarged successfully. In the study of the stars, which are so far away that they appear only as points of light even in the largest telescopes, the size of the image has no importance. But when an astronomer is looking at a planet or any other celestial body that shows as a disk, he wants the image to be as large as possible without losing its sharpness.

Mounting of the Telescope. Telescopes are set on very stable foundations, and they are mounted with great precision, balanced so that they can be turned toward any point in the sky. The earth's rotation makes the stars appear to drift westward, and the telescope must follow this motion. An electric driving clock in the telescope's mounting keeps it moving with the apparent motion of the stars. The dome covering the telescope turns so that the instrument can be directed through the opening or slit toward any point in the heavens. A dome is not heated, because warm air rising through the slit would disturb the seeing. Astronomers working on cold winter nights wear heavy clothing like that of Arctic explorers.

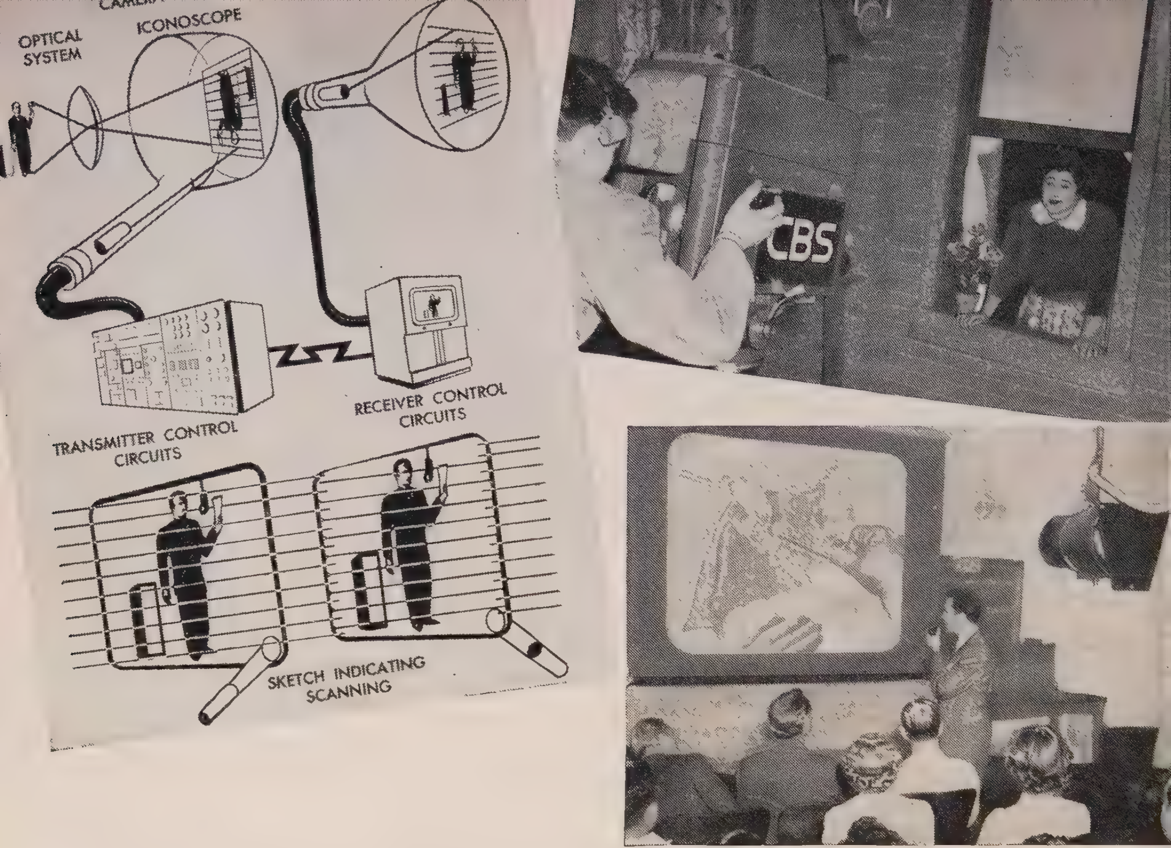
History. It was not long after the discovery of the properties of lenses that Galileo Galilei made the first telescope and in January, 1610, began telescopic studies of the planets, the moon, and the sun (see GALILEO). His instrument was a small tube with a lens at each end, and with it he discovered the four large satellites of Jupiter. He saw the moon's craters, and sunspots on the sun's disk. About fifty years later, Newton constructed a reflecting telescope of small size; the mirror was of polished metal. Reflectors made by Sir William Herschel were much larger, and he used a glass base, coated with silver. The large modern reflectors are coated with aluminum, which does not tarnish as silver does. The aluminum is deposited in vapor form and gives a very bright, hard surface to the mirror.

An important new type of telescope, invented by B. Schmidt, is designed to take photographs covering a field both wide and deep. It is a mirror and lens combination. The light entering the telescope passes through a thin lens of special shape that spreads the rays before they fall on the mirror. From the mirror the light is reflected to the photographic plate at the focus. With a short exposure, the Schmidt telescope takes photographs that are very sharp and clear to the very edge of the plate. The largest Schmidt telescope, in use at the Mount Palomar Observatory, has a 72-inch mirror and can record objects 300 million light-years distant. The most important project for this instrument is a map of the sky visible from Mount Palomar. The Schmidt photographs show many objects previously undiscovered and will provide a tremendous amount of material for further study. Many observatories are using Schmidts for patrol work, photographing the same region from time to time in order to catch any changes or new developments.

See also ASTRONOMY; LENS; OBSERVATORY.

TELEVISION. With the advent of television man gained the opportunity to watch events taking place in distant locations at the moment of their occurrence. Like radio, television brought instantaneous transmission of sounds originating hundreds of miles away; like motion pictures, it presented images to the spectator's eye. By the middle of the twentieth century, television sets in millions of homes in various parts of the world were exerting a powerful influence on habits, attitudes, economics, and education.

The Television Camera. The lens of the television camera focuses the light rays from the picture being televised not on a film, as in a motion-picture camera, but on a hollow tube called the *iconoscope,* a form of photoelectric cell. This tube, or an improved, more sensitive version of it called the *image orthicon,* transforms the picture into an electrical code message. At one end of the iconoscope is a small rectangular screen called the *mosaic;* at the other is an electron gun, which fires a stream of electrons — small negative particles of electricity — at the mosaic. On the way there they are brought to a pinpoint focus by magnetic coils. A carefully timed series of electrical impulses controls the beam so that the mosaic is sprayed from left to right in straight parallel lines. When one line is completed, the beam snaps back to the


ICONOSCOPE
OPTICAL SYSTEM
RECEIVER CONTROL CIRCUITS
TRANSMITTER CONTROL CIRCUITS
SKETCH INDICATING SCANNING
CBS

Farnsworth Television and Radio Corp.; Remington Rand Inc.; CBS

THE BASIC WORKINGS OF TELEVISION, from camera to receiver, are shown at left. At top right, a drama of family life is televised for family viewing. At bottom right, a close-up of an operation is carried by coaxial cable to the auditorium of a medical school.

left-hand edge and drops to the next line. Scanning goes on at lightning speed.

Every school child knows the trick of drawing lines on a paper covering a coin so that the face of the coin will appear on the paper. The more lines drawn, the more distinct the picture. Similarly, scanning in television is a means of dividing a picture into lines of light; the photoelectric cells pick out the variations in light and shadow just as the pencil moving across the paper picks out high and low spots on the surface of the coin.

The mosaic is a thin sheet of mica, and covering the mica are millions of tiny drops of silver treated with cesium oxide, a substance selected for its photoelectric properties. When light falls on the mosaic, each tiny drop gives off free electrons, which are drawn away by a strong positive voltage. The number of electrons set free by each of these tiny photoelectric cells depends upon the amount of light received. But almost instantly the electron beam sweeps across the mosaic, scanning hundreds of lines in a fraction of a second, and each tiny droplet of silver receives from the beam the number of electrons it has lost. The sharpness of the image depends on the number of lines on the screen; in the United States the 525-line system is generally used, but other systems have from 405 to 819 lines. In every case an electrical picture is being continuously formed and erased on the mosaic. Since the fluctuations are very faint, amplifiers are used to increase their strength, but their pattern is not changed. In the image orthicon, reflecting surfaces are used to multiply the electrons, increasing the sensitivity of the camera.

The pattern of the electrical impulses is known as the *signal.* Radio waves similar to those used in radio broadcasting carry the signal to the antenna of a television receiver. Speech and sound signals are also sent to accompany this telecast, but these are collected and transmitted exactly as in radio broadcasting. In addition, a signal is sent to ensure that the sending and receiving scanners are synchronized. This signal and the picture signal are picked up by an antenna, amplified several thousand times, and fed into the receiving set.

The Television Receiver. At the receiving end, the *kinescope,* or picture tube, reassembles the picture broken up in the television camera. The narrow end of the funnel-shaped picture tube is an electron gun; the other end is flattened and coated on the inside with

RCA; Dumont; NBC

PERCHED IN A CROWDED BASEBALL PARK, the television camera catches the action for spectators many miles away (bottom). A mobile television transmitter weighs little more than fifty pounds and can be carried on the operator's back (top left). With a number of cameras in action, the director at the control board selects the particular view which will appear on thousands of television sets (top right).

a substance which gives off light when struck by electrons. The picture which appears on this screen is visible from the outside of the tube. As in the camera, the electron beam of the receiving tube sweeps back and forth across the screen; both beams are locked in step by the synchronized signal.

The picture signal controls the firing of electrons in the picture tube so that wherever a bright spot showed on the mosaic, electrons strike the viewing screen. Where the mosaic was dark, no signal was sent; and therefore the viewing screen remains dark at that spot. In this manner, thirty complete pictures are sent and received each second, each picture, in American receivers, being made up of 525 lines. Besides appearing on the screens of television sets, the images can be transferred to film and projected onto the large screens in motion-picture theaters.

Television Transmission. The television wave sent through space from a transmitting station must carry a great amount of information. One television station needs as much space for its sending channel as is used by six hundred radio stations. Therefore the television industry in the United States was originally assigned channels in the short-wave region where very high-frequency waves must be used. When this region became crowded, channels in the ultra-high-frequency region were available for television. The very short television wave travels in a nearly straight line and is not reflected back to the earth from above, like the radio wave. For this reason the antenna of a sending station must be mounted as high as possible, so that the outgoing wave will not be obstructed by buildings, hills, or other obstacles in its path; and receiving stations must be located no farther away than the horizon, or the curvature of the earth will cause the television wave to be lost in space.

The problem of conquering distance is solved in some cases by running special cables between cities. Ordinary telephone and telegraph wires cannot be used for these television networks, because the high-frequency waves of television would leak off and be lost before reaching the end of the line. A *coaxial cable*, a hollow metal tube carrying a copper wire supported by insulating material, serves the purpose, since it greatly reduces leakage. Relay stations, spaced about thirty miles apart, perform the same function as the cable by "leap-frogging" programs from one station to the next.

Although portable or built-in antennas for receiving sets are adequate in some locations, many television receivers generally require roof antennas for best reception. The simple, T-shaped dipole antenna is widely used, as are more elaborate structures for increasing the strength of the incoming signal.

Color Television. Color television is no different in principle from dark and white reproduction. It has long been known that the colors red, green, and blue, when added together, form a full-color picture. In the method which first gained prominence in the United States, a rotating disk with red, green, and blue filters separated out these colors from the light entering the camera lens. Another color wheel in front of the picture tube of the receiving set restored the colors before the eyes of the viewer. A second method involved the use of an electron gun, or guns, to produce color without disks or other moving parts.

Telecasting. Most television programs originate in studios similar to, although considerably larger than, radio broadcasting studios. Several cameras may be used to shoot pictures from various angles and distances or to switch from one scene to another. Motion-picture film is frequently introduced in a telecast to provide outdoor scenes, special action shots, and commercial advertising material. Some programs are filmed for rebroadcast. Clever use is made of miniature sets, dramatic lighting, and other equipment and techniques related to those of the motion-picture studio. From sports arenas, baseball parks, public buildings, and other locations outside the studio, portable television stations relay telecasts to the main station, where they are amplified and sent out on the air.

The very high cost of television programs presents a serious problem to sponsors, and the fact that the telecasting of sports events may drastically reduce attendance raises another economic difficulty. A possible solution in the United States was suggested by *Phonevision,* a system which requires viewers to pay for what they see. As originally introduced, Phonevision presented motion pictures, which were sent in blurred form over television channels. A device on the receiving set, connected by telephone wire to the Phonevision switchboard, unscrambled the image when the individual set-owner indicated his desire to see the program. The viewer was billed for each show thus received.

Besides its value as a source of entertainment, television has proved its usefulness in many other fields. Educators know the merits of audio-visual teaching. In medical schools students in a classroom may observe an operation and listen to the surgeon in charge, obtaining a much closer view than is possible from the gallery of an operating room. Engineers in industry and scientists in experimental work can control dangerous processes from a safe location while watching what takes place. The possible range of uses for television is immense, and new applications are constantly appearing.

Development. Scientists and inventors in many countries contributed important ideas to the development of television, and earlier progress in electronics and allied fields was essential to its birth. The basic inventions required to make television possible were known before World War I, but it was not until 1925 that Charles Francis Jenkins, an American inventor, showed that the outline of a picture could be successfully transmitted. The next year a Scotsman, James L. Baird, proved to London scientists that more than mere outlines could be televised.

Investigators early realized that an image to be televised had to be broken up into small units, each of which could then be sent independently to a receiving station, where all the units could be reassembled on a screen. The whole process had to be carried out so swiftly that only the complete picture, and not the separate units, would be visible to the eye. Thus the eye must be tricked, as in motion pictures, where twenty-four separate images are flashed on the screen each second, giving the impression of continuous action.

Baird and Jenkins each made use of the invention of Paul Nipkow, a German, who around 1884 suggested that a rotating disk with holes punched in a spiral along its edge might be used to *scan* a picture — that is, to break it up into parts. A person to be televised sat in front of this disk, which rotated at high speed, and a powerful arc light was placed so that rays of light passed through the holes to the person's face. Reflected light was picked up by photoelectric cells, which gave off electric impulses. At the receiving station a similar scanning disk revolved between a neon light and the screen upon which the picture appeared. Both disks had to revolve in step with each other and at the same speed. The neon light varied in brightness owing to signals from the photoelectric cells at the sending station, where these signals were amplified and sent by radio to the receiving set.

In the late 1920's the individual efforts of Vladimir K. Zworykin and Philo T. Farnsworth helped to perfect a much more efficient method of scanning based on the cathode-ray tube. The electron gun used in the new tubes made possible the scanning of a picture with much greater speed than could ever be attained by a rotating disk and produced a far better image. Stimulated by these improvements, regular television programs were begun in 1936 in England and in 1939 in the United States. By mid-century millions of sets were in use in the United States, and the number of transmitters was increasing rapidly. About a quarter of a million sets were in use in the United Kingdom, and there were thousands in France and the Soviet Union. Other nations engaged in television research, experiment, and production included Canada, Australia, Denmark, Italy, Czechoslovakia, Argentina, and Brazil.

American television followed the pattern of American radio in relying chiefly upon advertisers for economic support. Entertainment, including musical shows, quiz shows, comedy, drama, motion pictures, and sports events, is presented by commercial sponsors, who pay the networks for the time used and advertise their products in the course of their programs. Time is devoted, on occasion, to the televising of some newsworthy events and some educational programs, without advertising, in the public interest. See also PHOTOGRAPHY; RADIO.

Books for Reading and Reference

DUNLAP, ORRIN ELMER. *Understanding Television.* Greenberg. An explanation of television for the average person.

HARRINGTON, RUTH LEE. *Your Opportunities in Television.* McBride. A helpful vocational survey.

RIVER, MILTON S. *Television Simplified.* Van Nostrand. A sound, up-to-date explanation.

TELL, WILLIAM, a famous mythological hero of Switzerland and the symbol of Swiss independence. In 1307, according to tradition, Gessler, the Austrian bailiff of the Canton of Uri, hung his hat on a pole in the village of Altdorf and required the citizens to pay homage to it. William Tell, a leader of the Swiss and a famous marksman with the crossbow, refused to obey Gessler's order; and to punish him, Gessler made him shoot at an apple placed on his young son's head. The boy was not harmed, but Tell had kept a second arrow in his belt, to use on Gessler if the feat had not been successful. While Tell was being taken across a lake on his way to prison, a storm came up and he was freed to steer the ship. Once on the shore, Tell leaped out and sent an arrow into Gessler's heart. The story was told in Schiller's poetic drama *William Tell,* and in Rossini's well-known opera of the same title.

THE LIFE OF HIS SON depended upon the keen eye and steady hand of Switzerland's great folk hero, William Tell.

TELLURIUM, *teh lyu'rih um,* a semimetallic element discovered in 1782 by Müller von Reichenstein, looks like a metal but in its chemical conduct acts like a nonmetal. Most of the tellurium now being produced is obtained as a grayish-white powder by reducing telluric oxide recovered from the tank slimes of electrolytic-copper refineries. Some telluric oxide is recovered from the residues of lead refineries. Tellurium also occurs in the form of *tellurides,* in which the element is combined with gold or with silver and gold. At Cripple Creek, Colo., the tellurides form rich ore deposits.

Tellurium is used chiefly in the production of alloys, particularly with lead and with copper. Lead alloyed with less than 0.1 per cent tellurium is more durable than pure lead and more highly resistant to corrosion and to acids. When copper is alloyed with small percentages of tellurium, it becomes more easily machinable. In the vulcanizing of rubber with sulfur, the addition of about 1 per cent tellurium to the sulfur yields a rubber that is more resilient and more resistant to heat, oxidation, and wear.

The symbol for tellurium is Te. The atomic weight is 127.61, the atomic number 52, specific gravity 6.24, and melting point 452°C. Tellurium compounds are used in ceramics and photography.

TEM'PERA. See PAINTING, *Techniques of Painting and Drawing.*

TEM'PERANCE, the movement to curb the use of intoxicating beverages. Originally, the term referred to habitual moderation in all things; later, it was limited to the use of intoxicants, and eventually it came to mean total abstinence. Since ancient times most religions and philosophies have condemned intemperance in drinking. Buddhism and

Mohammedanism, as well as many Protestant groups, teach total abstinence.

History. The problem of intemperant drinking did not become acute until after the appearance of distilled liquors in the thirteenth century. Drunkenness became very prevalent in England in the eighteenth century, at the beginning of the Industrial Revolution. The English temperance movement, beginning about 1830, acquired a powerful influence through its program of moral and religious suasion. The crusade spread to the continent, gaining its greatest support in the Scandinavian countries. The first international organization to promote the movement was the International Order of Good Templars, which originated in the United States in 1851 and was introduced into Great Britain in 1868; it stressed total abstinence, advocated the suppression of the liquor traffic, and preached universal brotherhood and world peace. Another active organization was the World's Woman's Christian Temperance Union, organized in 1883. The temperance movement reached its peak in the period after 1900. The Scandinavian countries, most of Canada, and some other countries adopted prohibition but abandoned it about 1920.

The United States. The American Temperance Society, organized in 1826, was an influential force in the temperance movement. Very strong during the 1840's, it then gave way to the slavery controversy until after the War between the States. The organization of the Prohibition Party in 1869 and of the Woman's Christian Temperance Union in 1874 marked the beginning of another wave of temperance activity. The movement first concentrated on persuasion and education but soon turned toward the policy of legal prohibition. In 1895 appeared the Anti-Saloon League of America, under whose leadership the prohibition campaign culminated in the adoption of the Eighteenth Amendment to the Constitution (1919), which outlawed the saloon throughout the United States.

Although national prohibition came to an end in 1933, the temperance movement continued to be very active. Thousands of communities voted dry in local-option elections. The Woman's Christian Temperance Union, the Temperance League of America, and the National Temperance League intensified their programs of education and propaganda; and since its establishment in 1934, Alcoholics Anonymous, an organization of reformed drinkers, has been active in the reclamation of alcoholics. See also PROHIBITION.

TEM'PERATURE, the state of a body described roughly by such terms as hot, warm, cool, or cold. When a cold body is heated it not only feels warmer but also undergoes changes in size and other properties. Some of these changing properties are utilized in the construction of thermometers, which make it possible to describe the temperature of a body by means of a number on a temperature scale (see THERMOMETER). When a hot body is in contact with a cold one it is observed that the hot body always becomes cooler and the cold one warmer, until they reach the same temperature. That is, heat flows spontaneously from a body to cooler bodies or regions only, never to warmer ones.

In the kinetic theory of matter the temperature of a substance is identified with the average kinetic energy of the random motions of its molecules, and its heat content with the total energy of all its molecules. The temperature of a body is therefore not the same thing as its heat content. Thus a pint and a gallon of water, boiling in separate vessels, have the same temperature, and the water molecules in the two containers have the same average kinetic energy. But the gallon of water has a greater heat content than the pint because the total energy of all its molecules is greater.

A temperature less than a degree centigrade from absolute zero has been reached by the evaporation of liquid helium under reduced pressure (see ABSOLUTE ZERO). The lowest temperature attained so far, only 0.0044 degree above absolute zero, was obtained by a magnetic method. A magnetic salt is cooled by liquid helium that surrounds its container. A strong magnetic field is then applied, which lines up the tiny molecular magnets of the salt parallel to the field. The heat of magnetization is carried off by evaporation of some of the helium. When the magnetic field is removed the directions of the little salt magnets become random again. The heat required for these changes in direction can come only from the salt itself, which is thus cooled. With each cycle of magnetization and demagnetization there is a small, but decreasing, amount of cooling of the salt.

Though lower temperatures have been reported, the lowest official temperature recorded was −90°F. at Verkhoyansk, Siberia, in February, 1892; the highest shade temperature recorded under standard conditions was 136.4°F. in Libya, North Africa, about 25 miles from Tripoli, in September, 1922.

At the surface of the sun the temperature is about 6000°C., or 10,800°F.; but the surfaces of certain red stars are around 3000°C. (5400°F.), and those of the bluish-white stars may reach 50,000°C. (90,000°F.). Temperatures of interiors of stars are calculated to be of the order of magnitude of tens of millions of degrees centigrade. See also TEMPERATURE, BODY; THERMOCOUPLE.

TEMPERATURE, BODY. The body temperature of the normal healthy adult ranges between 98° and 99°F. and in most persons averages about 98.6°F. It is kept more or less constant by a heat-regulating center in the brain, which balances the amount of heat produced by the body with the amount of heat the body loses to the environment. During each twenty-four-hour period the body temperature fluctuates slightly within its normal range. Usually it reaches its highest level while one is awake and drops to its lowest level during the sleeping hours. But there are many individual variations, such as the morning type, whose temperature peak is attained early in the day, and the evening type, whose temperature rises to the highest point at night.

When the body temperature rises above normal, fever results. The rise is caused by infection or disease. A temperature rise above 106°F. is frequently fatal, but temperatures as high as 113°F. have been recorded. Low temperatures may also be dangerous, those less than 70°F. almost invariably causing death. However, persons with temperatures as low as 65°F. have survived. See also FEVER.

TEM′PERING, or drawing, in metallurgy is the reheating and subsequent cooling of carbon steels that have been hardened by rapid cooling (quenching) in a bath of water, brine, or oil after being heated to a high temperature. This second heating, always to a temperature much lower than in the previous one, relieves internal strains in the steel, toughens it, and reduces its brittleness and also to some extent its hardness. The term tempering is often loosely used for the entire process of heat treatment.

Physical properties of tempered steel are related to its crystal structure, which depends in part upon the temperature reached during tempering, the length of time that temperature is maintained, and the manner and rate of cooling. The greater the tempering temperature used (always less than about 1300°F.), the greater is the ductility and machinability of the steel and the less its hardness and tensile strength (see TENACITY). To give steel the qualities desired for its intended use, the tempering process is carefully carried out. In one method skilled artisans stop the heating of a steel tool or part when the oxide on its surface reaches some definite color. This color changes and darkens as the temperature rises. Many steel parts may be tempered at the same time in a bath of oil, molten lead, or other liquid kept at the proper temperature. Quenching may be necessary in these methods. One method utilizes a completely controlled temperature cycle in a furnace.

Cutting tools must be hard enough to hold an edge but not so brittle that they shatter in use. They are therefore tempered at lower temperatures than springs, for example, which must bend without breaking and return to their original shapes when the bending stress is removed.

Brown Brothers

THE KNIGHTS TEMPLARS not only protected pilgrims in the Holy Land but also labored to convert those knights who had fallen into sin.

TEMPLARS, *tem′plurz,* KNIGHTS, one of three military monastic orders established during the Crusades (see CRUSADES). It was organized in 1119 at Jerusalem by eight knights to protect Christian pilgrims in the Holy Land, but soon it developed into a great military order devoted to the defense of Palestine against the Saracens. Members took the monastic vows of poverty, chastity, and obedience. The head of the order was the grandmaster, who was subject only to the pope. The order spread throughout Christendom and grew strong and wealthy; international banking became one of its chief activities. After the final expulsion of the Crusaders from Palestine in 1291, the order moved its headquarters to Cyprus. Soon afterward, Philip IV of France, coveting the wealth of the order, brought charges against the Templars, who were accused of licentiousness and apostasy. The order was suppressed in 1312 and its property confiscated.

Modern Knights Templars. This is one of the higher degrees in the order of Freemasonry (see MASONRY).

TEMPLE, generally, a shrine dedicated to a god. The early peoples often placed their temples on hills or on high places, partly to make them stand out above less important buildings, partly to mark the ancient belief that the world began as a hill. The Temple of Solomon in Jerusalem, one of the most famous of early temples, is described in I Kings 6:7. It was a richly decorated stone building divided into two rooms, the sanctuary and the holy of holies; in the latter was the Ark of the Covenant. This temple was destroyed by Nebuchadnezzar in 586 B.C.

A new edifice, erected after the return of the Jews from captivity in Babylon, was finished about 516 B.C. Five hundred years later Herod the Great restored and rebuilt the Temple in magnificent style, but the Romans demolished it with the rest of the city when they took Jerusalem in A.D. 70. The Mosque of Omar, or Dome of the Rock, built by the Turks on the site of the Temple, dates from the end of the seventh century.

Because religion has always been the core of civilization, every people has put the best of its artists and builders to work on shrines that would be considered worthy dwellings for their gods. The temples of antiquity represent the finest artistic efforts of the people who erected them. Egyptian temples were generally massive stone structures of great weight and dignity. The classic Greek temples were simple, flat-roofed, rectangular buildings, usually surrounded by rows of graceful columns and decorated with painted stone reliefs. The Parthenon, the great temple of Pallas Athene on the Acropolis of Athens, was one of the masterpieces created in the golden age of Greek art. Roman temples sometimes followed the Greek style, but the Romans learned to build vaulted ceilings and domes (see Pantheon).

Strictly speaking, all churches are temples, but in modern times the word is generally applied to places of worship used by Mormons or by Jewish congregations of the reformed faith, to buildings that resemble the temples of antiquity, and to the headquarters of fraternal societies, such as the Masons.

TENACITY, *tee nas'ih tih,* a general term used chiefly in mineralogy for the resistance a substance offers to various kinds of forces. If a substance returns to its original shape after removal of a bending, compressing, shearing, stretching, or other force it is *elastic;* if it does not so return it is *flexible.* Other terms such as brittle, ductile, malleable, and sectile (capable of being cut in thin shavings) are also used to describe the various kinds of tenacity minerals may have. These properties are related to the cohesiveness and the crystal structure of a solid substance.

The strength of metals and other engineering materials is given, however, by other and more exact terms. A force tending to stretch a wire, for example, produces a *tensile stress* measured usually in such units as pounds per square inch (lb./sq. in.) or kilograms per square centimeter (kg./sq. cm.). The maximum value of the tensile stress that can be applied without rupturing the wire is the *tensile strength* (sometimes called tenacity) of the wire. Similar definitions may be made for strength of materials under stresses produced by compressing, shearing, torsional, and other forces. Engineers are also interested in the *elastic limit* of a material, which is the maximum stress that can be applied without leaving the material permanently deformed after its removal.

Wood has a greater resistance along the fiber, or grain, than across it to stresses of tension and compression. Materials for walls and foundations of buildings must resist crushing stresses. Typical values for resistances to crushing are:

Material	Resistance (lb./sq. in.)
Brick (hard burned)	4,500 - 6,500
Concrete	800 - 3,800
Granite	9,700 - 34,000
Limestone	6,000 - 25,000

Typical values for tensile strengths of materials are:

Material	Tensile strength (lb./sq. in.)
Aluminum wire	30,000 - 40,000
Brass wire	50,000 - 150,000
Lead (cast or drawn)	2,600 - 3,300
Steel piano wire	325,000 - 390,000

TENANT. See Lease.

TENDER, in law, is an offer to pay a debt or other obligation by money or service. Tender made in money, in the coin or currency authorized by law for the payment of a debt, is defined as *legal tender.* A creditor can object to a check as not legal tender. The United States Code, adopted in 1933, makes all coins or currency issued by or under the authority of the United States legal tender for all debts, public and private. Before the passage of this bill, some kinds of paper money had not been legal tender; also, pennies and nickels were legal tender only up to twenty-five cents, and dimes, quarters, and half dollars up to ten dollars. See also Money.

TENDONS, *ten'dunz,* or **SINEWS,** *sin'yooz,* are the cords by which muscles are attached to bones. They consist of bundles of tough, white fibers and are covered with a double-layered membrane, containing a lubricating fluid. Although most tendons are rather short, a few reach considerable lengths, such as the finger tendons which extend from the upper part of the forearm and the *tendon of Achilles,* a large, strong tendon reaching from the ankle to the heel. Tendons are subject to a number of disorders. Inflammation may result from injury or overuse, and tumors may also form in tendons. The tendons of certain animals, notably the kangaroo, are sometimes used in surgery for suture threads or for ligatures.

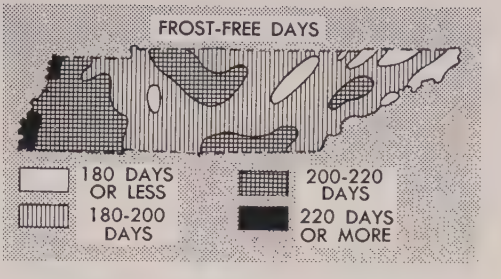
TENERIFE, *ten'ur if.* See Canary Islands.

TENIERS, *teh neers', ten'yurz,* or *tay nya',* the family name of two famous Flemish painters, father and son. Both were born in Antwerp.

David Teniers, The Elder (1582-1649), was a pupil of Rubens. His pictures of the country and country people are characterized by realistic detail, humor, and fine color.

David Teniers, The Younger (1610-1690), studied under his father and surpassed all other Flemish artists as a painter of everyday scenes. He was the last of the great painters of Flanders; no important artists followed him. He became a skillful painter while still in his teens and had a highly successful career, winning the patronage of the Spanish viceroy and visiting the royal courts of foreign lands to fulfill commissions. His pictures excelled in arrangement of figures, color, and light. The illumination in his paintings is gentle and delicate. Similar restraint is shown in his warm, cheerful coloring. His brushstroke was facile and swift, and many of his portraits were begun and finished in only one sitting. He left about seven hundred paintings and many drawings. He is represented in most of the great art galleries of the world.

TENNESSEE, *ten eh se′*, the "Volunteer State," owes much of its greatness to the pioneering spirit which has remained alive since the days of the earliest settlements. During the nineteenth century three of its sons — Andrew Jackson, James K. Polk, and Andrew Johnson — reached the White House, and down the years other influential Tennesseans, from David Crockett and Sam Houston to David Farragut and Cordell Hull, have worked, in the frontier tradition, for the expansion of America's boundaries and for true political democracy. The great Tennessee Valley Authority (TVA), launched in the 1930's, introduced a new kind of pioneering, heralding both social and economic progress.



TENNESSEE'S GROWING SEASON is longest along the Mississippi, shortest in the mountains in the eastern part of the state.

The Land and Its Aspects

Location and Surface Features. Tennessee is bordered by Kentucky and Virginia on the north and by Georgia, Alabama, and Mississippi on the south. North Carolina lies to the east, and Arkansas and Missouri to the west. The western boundary consists of a series of bends in the Mississippi River. The eastern boundary is crossed by the Great Smoky Mountains, which are so called because of the bluish haze which hovers over them. The state slopes westward from these mountains in an ever-lower series of ranges, plateaus, basins, and valleys to the Mississippi bottomlands.

East Tennessee embraces the Appalachian Ridge and Valley area and the Cumberland Plateau. The highest point in the state is Clingman's Dome (6,642 ft.) in the Great

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Total Area: 42,246 square miles, of which 285 square miles are inland water.

Rank in Size: Thirty-third.

Population (1950): 3,291,718.

Density of Population: 77.9 persons per square mile.

Rank in Population: Sixteenth.

Chief Cities: Nashville (capital, 173,359), Memphis (394,012), Chattanooga (130,333), Knoxville (124,183).

How Acquired: British cession (1783) and North Carolina cession (1789).

Date of Admission to Union: 1796.

Noted for: Agricultural products (corn, cotton, tobacco, peanuts); minerals (coal, phosphate rock, copper); manufactures (cotton goods, rayon, plastics, aluminum).

Nicknames: Volunteer State, Big Bend State.

Flower: Iris.

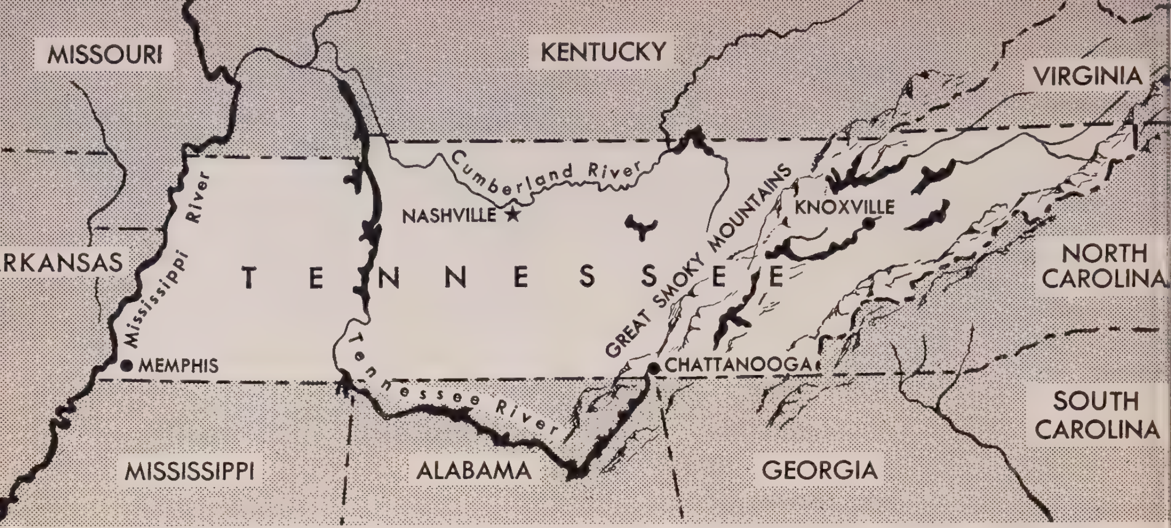
Bird: Mockingbird.

Song: "My Homeland, Tennessee"; words by Nell Grayson Taylor and music by Roy Lamont Smith.

Motto: Agriculture and Commerce.

Seal: The upper portion of the seal's disk contains pictures of a plow, a sheaf of wheat, and a cotton plant, typifying the state's agriculture. In the lower portion is a picture of a flatboat which was the state's earliest freight carrier and which therefore symbolizes commerce. The Roman numeral XVI indicates that Tennessee was the sixteenth state to join the Union. The circular border contains the words: The Great Seal of the State of Tennessee, February 6, 1796.

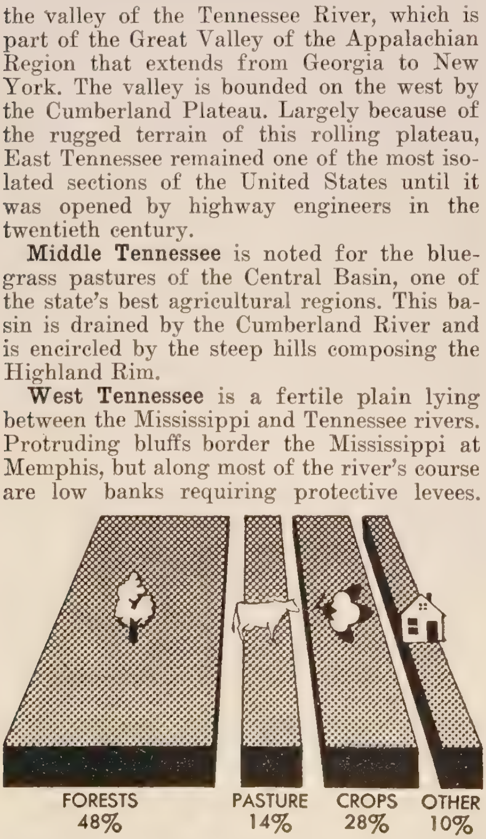
Flag: The red field is bordered at the fly edge with a narrow white stripe and a wide blue stripe. A blue disk, rimmed with white and bearing three white stars, appears in the center of the flag.



Smoky Mountains, the loftiest mountain mass of the Appalachian chain. Because the Smokies represent one of the last remnants of the primeval eastern wilderness, the spectacularly scenic area which they cover in eastern Tennessee and western North Carolina has been set aside as the Great Smoky Mountains National Park. Southwest of Knoxville lies the valley of the Tennessee River, which is part of the Great Valley of the Appalachian Region that extends from Georgia to New York. The valley is bounded on the west by the Cumberland Plateau. Largely because of the rugged terrain of this rolling plateau, East Tennessee remained one of the most isolated sections of the United States until it was opened by highway engineers in the twentieth century.

Middle Tennessee is noted for the bluegrass pastures of the Central Basin, one of the state's best agricultural regions. This basin is drained by the Cumberland River and is encircled by the steep hills composing the Highland Rim.

West Tennessee is a fertile plain lying between the Mississippi and Tennessee rivers. Protruding bluffs border the Mississippi at Memphis, but along most of the river's course are low banks requiring protective levees. Floods of the high-water season have contributed to the formation of cypress-lined swamps, marshes, and bayous. Reelfoot Lake, the only important natural lake of Tennessee, was created when Mississippi waters filled a depression caused by earthquakes.



IN SPITE OF INDUSTRIAL PROGRESS, farming and livestock raising still claim millions of acres in Tennessee.

Climate. Except in the mountains, Tennessee has a mild and equable climate, with an average January temperature of 39°F. and a July average of 79°F. The heaviest rains occur in early spring, when floods threaten on the Mississippi and its tributaries. The annual precipitation averages 47.2 inches. The hot, humid summers have given parts of West Tennessee a subtropical climate.

The People and Their Activities

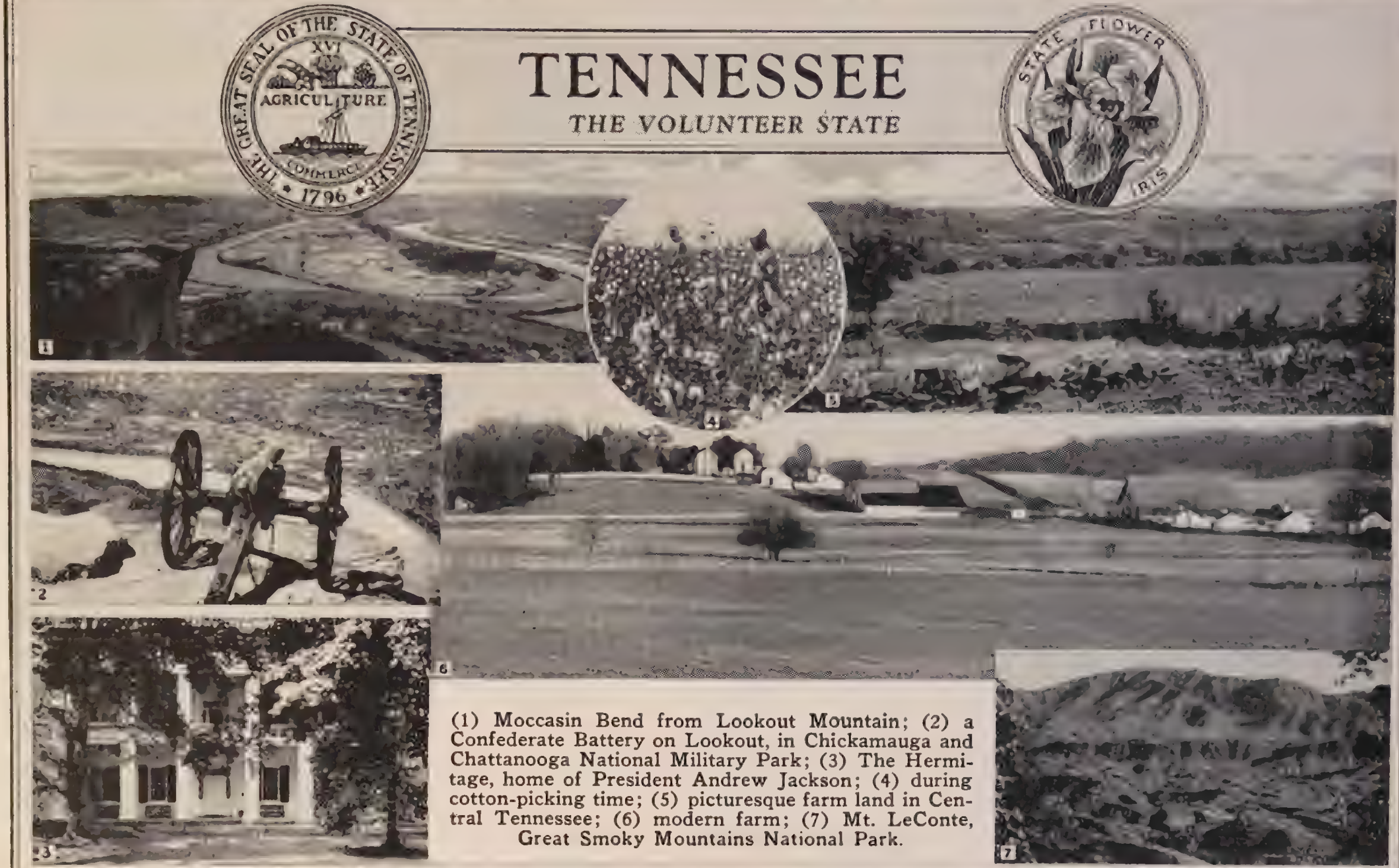
The People. Tennessee is distinctive among the states for its large mountain population. Descended from British and Scotch-Irish settlers of the Revolutionary period, these people are often called our contemporary pioneers, because many still live in log cabins and until fairly recent times followed the way of life of their ancestors. They have preserved crafts, songs, dances, and ways of speech which date back to Elizabethan days. Now, however, new roads, new schools, and new electrically driven machinery made possible by TVA dams are bringing this unique group into the main stream of American life.

As in other Southern states, most of the people of Tennessee are of Anglo-American stock, although some are descended from the French Huguenots and the Pennsylvania Dutch. The majority of the recent immigrants have come from Germany, Italy, Russia, Poland, and Great Britain. Negroes, who constitute 18 per cent of the population, have long been numerous in Middle and West Tennessee, the great cotton-raising sections.

Farming. Although corn leads all other Tennessee crops in value, much of it is used on the farms as feed for livestock. The chief cash crop is cotton, which is raised in such large amounts by plantation owners, white

TENNESSEE

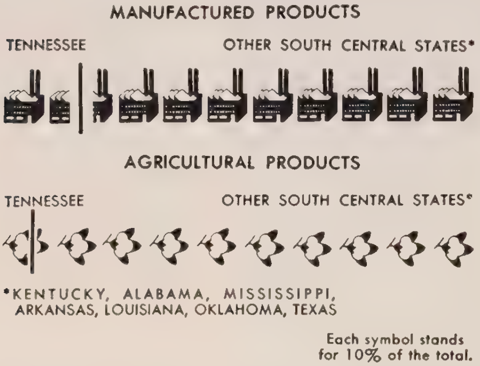
THE VOLUNTEER STATE



(1) Moccasin Bend from Lookout Mountain; (2) a Confederate Battery on Lookout, in Chickamauga and Chattanooga National Military Park; (3) The Hermitage, home of President Andrew Jackson; (4) during cotton-picking time; (5) picturesque farm land in Central Tennessee; (6) modern farm; (7) Mt. LeConte, Great Smoky Mountains National Park.

tenants, and Negro sharecroppers that Tennessee ranks seventh among the states in cotton production. Similarly, tobacco returns a much larger amount of money than the more valuable hay and forage crops. Burley tobacco, used in cigarettes and for smoking, is grown in East Tennessee, and dark-fired tobacco is produced in Middle Tennessee.

As a participant in the diversified-agriculture program of the New South, Tennessee raises not only various grains but such products as peanuts, pecans, and sweet potatoes. The bluegrass of the Central Basin has encouraged the breeding of dairy and beef cattle, of mules, and of blooded horses like the saddle mount known as the Tennessee walking horse. Hog raising is carried on in Middle Tennessee, poultry raising in East Tennessee, and sheep grazing in the Highland Rim and the Ridge and Valley area. Truck gardens in the northwest produce a variety of vegetables and small fruits for both home consumption and northern markets.



AMONG THE SOUTH CENTRAL STATES Tennessee ranks second in the value of its manufactures and sixth in the value of its agricultural products.

Mining. The leading mineral resource of Tennessee is bituminous coal, which underlies a large part of the Cumberland Plateau. Phosphate rock is obtained from the Central Basin, and copper ore from the Ducktown district in the southeast. Among the by-products of copper smelting are gold, silver, and sulfuric acid. The marble quarried near Knoxville is outstanding among the various building stones produced in the state. Other mineral wealth includes iron ore, zinc, lead, barite, feldspar, sand, gravel, and clays.

Manufacturing. Tennessee owes its diversified industry to its minerals, its agricultural and forest products, and its TVA-generated electricity. The leading industrial centers are Memphis, Nashville, Chattanooga, Knoxville, Kingsport, Bristol, and Johnson City. Of primary importance are the various cotton and cottonseed products. These range from textiles and plastics to cooking oils and livestock feed. Furniture and veneers are among the products made from hickory, oak, maple, and other hardwoods. Tanning materials are extracted from oak bark, pencils and buckets are made from red cedar, and the pulp derived from shortleaf and loblolly pine is made into newsprint and kraft paper. There are chemical plants producing fertilizers and insecticides, aluminum-reduction plants, and pottery factories producing tableware and electrical porcelains. The availability of TVA power led to the selection of Oak Ridge, near Knoxville, as the site of a major atomic-energy project.

Transportation. The first important roads in Tennessee were Avery's Trace, blazed across the Cumberland Plateau to Nashville in 1788, and the Natchez Trace, developed in 1807 from an Indian trail to link Nashville with Natchez, Miss. Today the state has more than 65,150 miles of rural roads, most of which are surfaced. Of equal importance is water transportation, by means of keelboat and flatboat in pioneer times and by means of tugboat and barge today. This cheap method of shipping freight has assumed still greater importance since a nine-foot, low-water channel was constructed, under TVA auspices, the entire length of the Tennessee River. Rail transportation was launched in 1856 on the completion of the Nashville and Chattanooga Railroad. Today the state's principal transshipment center is Memphis. Other important transportation centers are Nashville, Chattanooga, and Knoxville.

Government and Education

Government. In the Articles of the Watauga Association, framed by the settlers of the Watauga Valley in 1772 ,Tennessee claims to have the first constitution adopted by independent Americans west of the Alleghenies. The present constitution was adopted in 1870 during the Reconstruction period. It has seldom been amended. In 1953, it was amended for the first time since its adoption.

The general assembly, which convenes in Nashville, the capital, in January of odd-numbered years, consists of a senate of thirty-three members and a house of representatives of ninety-nine members, all elected for two-year terms. The only elected executive officer is the governor, who is chosen by popular vote for a four-year term. The legislature appoints the state treasurer and comptroller for two years and the secretary of state for four years. The five justices of the state supreme court are elected by popular vote for eight years; they appoint the attorney general for an eight-year term.

Education. Tennessee is indebted to Andrew Johnson for the effort which he made, while governor in 1854, to secure the adoption of a tax-supported public-school system. For many decades this system has been headed by the commissioner of education.

Tennessee is outstanding among Southern states both for the number and quality of its institutions of higher learning. Those which the state maintains for white students include the University of Tennessee in Knoxville, Memphis, and Martin and the Tennessee Polytechnic Institute in Cookeville. Among the notable private institutions are Vanderbilt University in Nashville, the University of the South in Sewanee, and the University of Chattanooga. Negroes attend Knoxville College and three Nashville institutions — Fisk University, Meharry Medical College, and Tennessee Agricultural and Industrial State College.

History

Early Days. Tennessee has been claimed by three nations — Spain, France, and Great Britain. The Spaniards established their claim when Hernando de Soto led his treasure seekers through the region to the banks of the Mississippi near present-day Memphis in 1540-41. The French claim was based on the landing of Joliet and Marquette in 1673 and on the establishment of a fort near the mouth of the Hatchie River by La Salle in 1682. English traders from Virginia began to penetrate the territory during the latter part of the seventeenth century. In 1756, in an attempt to retain the friendship of the Cherokee Indians, the British built the first Anglo-American fort west of the Alleghenies on the Little Tennessee River.

The British came permanently into possession in 1763, when the French ceded Tennessee, as part of Louisiana, at the close of the Seven Years' War. Settlement was promoted during the late 1760's and the 1770's with such scouts as Daniel Boone and such leaders as James Robertson and John Donelson pointing the way. During the early part of the Revolution the settlements along the Watauga River were organized as Washington District. In 1777 North Carolina annexed this district as Washington County. The Tennesseans from the Watauga Valley and from Fort Nashborough on the Cumberland, on the present site of Nashville, participated in the defeat of the British in the Battle of King's Mountain (1780).

When North Carolina ceded its over-mountain region to the Federal Government in 1784, the settlers organized the independent State of Franklin. North Carolina reasserted its jurisdiction over the Franklinites and Cumberland settlers in 1788, but a year later it relinquished the claim when Congress showed a willingness to organize the region as the Southwest Territory (or Territory of the United States South of the River Ohio). Through his treaties with the Cherokees the territory's first governor, William Blount, expanded the area of white settlement. By June, 1796, Tennessee had sufficient population to be admitted to the Union as the sixteenth state.

Progress as a State. Tennessee acquired its nickname of the Volunteer State during the War of 1812 and the Mexican War, when it contributed a larger number of recruits than many of the older states. On the outbreak of the War between the States it joined the Confederacy, despite considerable Unionist sentiment among the East Tennesseans. Before resistance was finally crushed in December, 1864, such historic engagements as Shiloh, Murfreesboro, Chattanooga, Franklin, and Nashville had taken place within its borders.

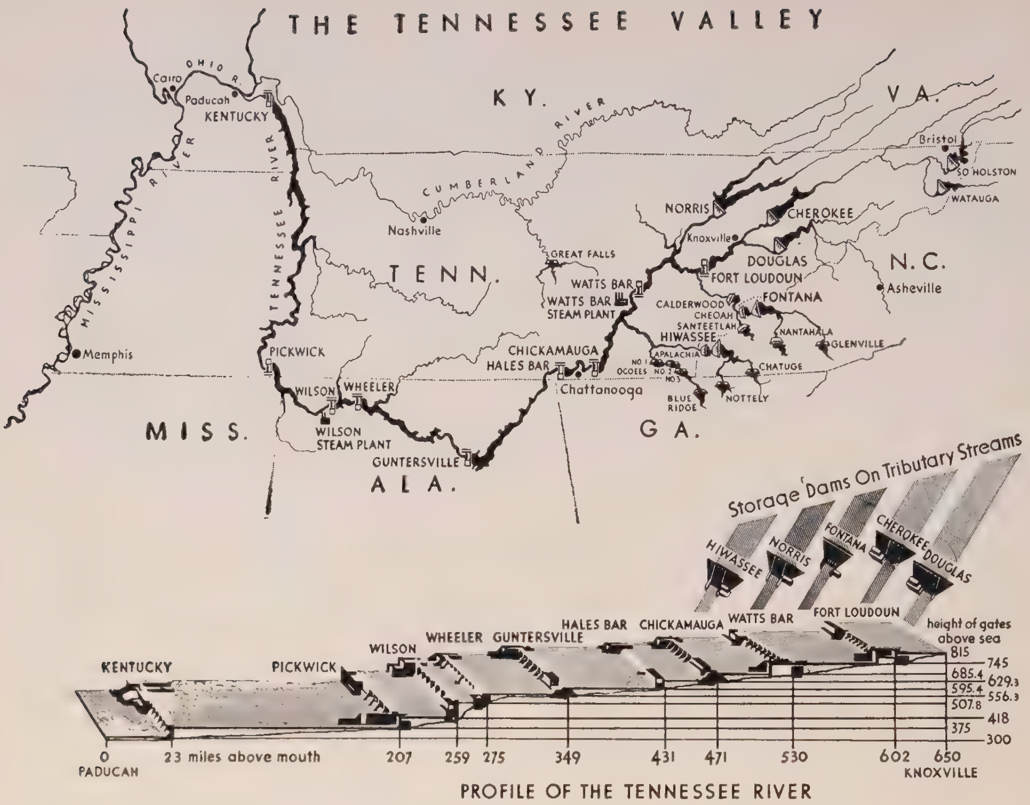
Tennessee was the first of the seceding states to be readmitted to the Union in 1866. It survived a corrupt and violent Reconstruction period, as well as a series of serious epidemics, and celebrated the hundredth anniversary of its statehood by holding a Centennial Exposition in Nashville in 1897. The greatest single development of the twentieth century was the creation of the TVA in 1933.

Tennessee's Interpreters

The first prominent fiction writer in Tennessee was the humorist, George Washington Harris. His successors have included Opie Read, Mary Noailles Murfree (who used the pseudonym Charles Egbert Craddock), Henry Sydnor Harrison, Roark Bradford, Harry Harrison Kroll, and Alfred Leland Crabb. T. S. Stribling won the Pulitzer prize for *The Store* (1932). Considerable influence has been exerted by the Nashville group of poets, critics, and novelists, which includes Allen Tate, Donald Davidson, John Crowe Ransom, and Robert Penn Warren. The state has produced many fine historians and biographers, the outstanding ones being Samuel Cole Williams, Philip Hamer, Frank L. Owsley, George Fort Milton, and Andrew Nelson Lytle. Representative artists include the sculptor Clark Mills and the painter George de Forest Brush. The operatic soprano Grace Moore was born in Tennessee.

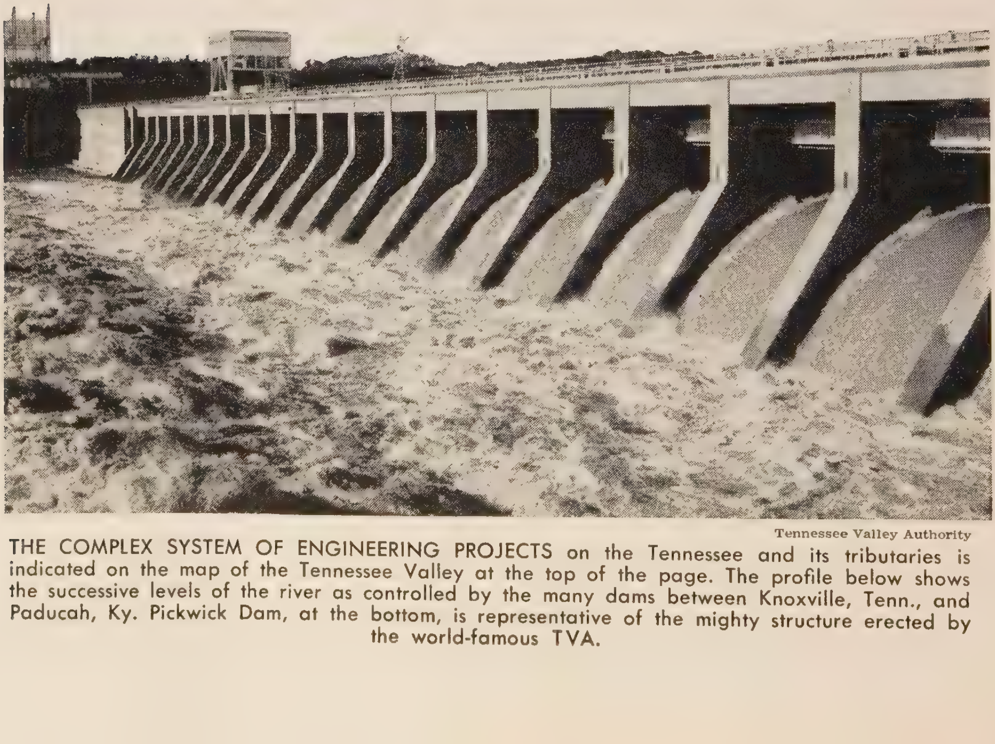
Related Articles. For further information, consult the following titles:

Chattanooga
Chattanooga, Battles of
Cherokee
Chickamauga, Battle of
Chickasaw
Cumberland Mountains
Cumberland River
Forts Henry and Donelson
Franklin
King's Mountain, Battle of
Knoxville
Ku Klux Klan
Memphis
Mississippi River
Murfreesboro, Battle of
Nashville
Parks, National
Reconstruction
Shawnee
Tennessee River
Tennessee Valley Authority
Watauga Association



THE TENNESSEE VALLEY

PROFILE OF THE TENNESSEE RIVER



Tennessee Valley Authority

THE COMPLEX SYSTEM OF ENGINEERING PROJECTS on the Tennessee and its tributaries is indicated on the map of the Tennessee Valley at the top of the page. The profile below shows the successive levels of the river as controlled by the many dams between Knoxville, Tenn., and Paducah, Ky. Pickwick Dam, at the bottom, is representative of the mighty structure erected by the world-famous TVA.

BIOGRAPHY

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Johnson, Andrew
Joliet, Louis
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TENNESSEE RIVER, the largest tributary of the Ohio River, is formed by the union of the French Broad and Holston rivers near Knoxville in eastern Tennessee. The Tennessee River system forms a great loop dipping to the south through Tennessee and across northern Alabama; its lower course recrosses Tennessee, flowing almost due north to enter the Ohio at Paducah, Kentucky. It drains an area of some 41,000 square miles; its length is about 650 miles, or 900 with the Holston and North Fork of the Holston. The waters of the Tennessee, the basic element in the great Tennessee Valley Authority development project, are controlled by a series of dams, which provide irrigation and hydroelectric power for a large area.

TENNESSEE VALLEY AUTHORITY, a public corporation of the Federal Government created by Congress in 1933 to carry out the unified development of the Tennessee River Valley region. The TVA is directly concerned with an area of about 41,000 square miles, comprising most of Tennessee and parts of Kentucky, Virginia, North Carolina, Georgia, Alabama, and Mississippi. This region is a rugged land of natural beauty, of rich resources, and of heavy rainfall; yet for generations before 1933 the hills had been denuded by heavy rains, and the valleys had been devastated by great floods. A soil once rich had been made poor, and a people once proud had become impoverished. As an engineering project the TVA is designed to tame the destructive river and to harness its energies for power production, for navigation, and for flood control; its social program involves the planned development of the whole region to promote soil conservation, exploit the natural resources of the valley, and advance the welfare of the people.

Harnessing the River. When the TVA was created in 1933 it took over Wilson Dam and other installations, the construction of which had been started at Muscle Shoals, Ala., during World War I. By mid-century the TVA itself had built seventeen more dams and was completing another, had purchased five dams from a private power company, and had made an agreement whereby it controlled the water release of five privately owned dams, thus bringing twenty-nine dams in the Tennessee system into the TVA.

No other major river in the world is so fully controlled as the Tennessee. The TVA system of dams and reservoirs has practically eliminated the danger of floods in the valley, and the reservoirs have created a nine-foot channel for navigation from the intersection of the Tennessee with the Ohio near Paducah, Ky., to Knoxville, Tenn., a distance of 630 river miles, with the result that traffic on the river has increased about thirteen times since 1933. Along the shores of the lakes created by the TVA dams are about forty parks maintained by the state and local governments.

Developing the Region. The TVA generators produce more than seventeen billion kilowatt-hours of electricity each year, making the region the second largest producer of power in the United States. During World War II about 10 per cent of the country's war material was produced in the Tennessee Valley. Ships were built here, hundreds of miles from the ocean. The major part of the aluminum for airplanes was produced in this region. And TVA research in the making of phosphates and other chemicals for fertilizers prepared the way for the manufacture of explosives. The abundance of water power was the primary reason for locating the great atomic energy plant at Oak Ridge, Tenn.

The TVA has insisted on the unified and balanced development of the region. Every industry must be planned with reference to the whole valley and with regard to its long-term effects. No one resource may be exploited at the expense of others; the development of one should promote the development of all. For example, no industrial project should be permitted to interfere with the programs of soil conservation and reforestation. As a planning agency the TVA has no power of compulsion; it operates solely through democratic persuasion and voluntary consent.

Conserving the Soil. In 1933 the Tennessee Valley was a region of thin soils and struggling people. The traditional farming methods had proved disastrous in the region, which has the highest hills east of the Rocky Mountains and the heaviest rains in the United States. Working with the more progressive farmers, the TVA set up a network of demonstration farms on which the principles of soil conservation and scientific farming are put into practice. These demonstration farms have proved that crop output can be increased by 30 per cent or more while the soil is being conserved and rebuilt. Many farmers have been persuaded to plant their hillsides with clover and to use TVA's cheap phosphate fertilizer for their cultivated acreage; the clover prevents erosion and enriches the soil, while the fertilizer increases the crop yield, thus compensating for the loss of acreage of cultivated land. Contour farming and terracing have been widely adopted. TVA farm experts have helped devise special machinery for the Tennessee Valley region.

The TVA has also engaged in a great program of reforestation to reclaim eroded land and to prevent further erosion. Many millions of trees have been planted, and the lumber companies have been persuaded to adopt better cutting practices.

Economic and Social Welfare. In 1933 the per capita production of electricity in the TVA region was about 60 per cent of the per capita average for the country; a decade later it exceeded the national average by about 50 per cent. During the same period the per capita income in the valley increased from about 40 per cent of the United States average to nearly 60 per cent. Today the people of the area use far more electricity than the national average, and they pay much less for it. Many thousands of farm homes have been electrified through co-operative distribution systems, and the region has become a great market for electrical appliances.

One of the major objectives of the TVA is to improve the social well-being of the people of the area. To do this, the agency works with the people of the valley, operating through local organizations and officials. In most cases the TVA merely advises and suggests. Town, city, county, and state agencies, state universities, and local co-operatives share in all the important projects. Through such methods the TVA encourages educational and health programs, local libraries, and the development of folk crafts.

Administration. As a government agency, the TVA is unique in that it is a public corporation clothed with all the powers of government but possessing the flexibility and initiative of private industry. It is governed by a board of three directors appointed by the President and confirmed by the Senate. In carrying out the objectives laid down by Congress the board has wide freedom of action, subject to a few general limitations. The corporation is financed by Congressional appropriations; the net profits from the sale of power and fertilizer go into the Federal Treasury. The headquarters of TVA are at Knoxville, Tenn.

History of the TVA. During World War I the United States began work on a power-development project at Muscle Shoals, Ala., for the purpose of manufacturing explosives. Wilson Dam and a nitrate plant were completed, but the facilities were not put into operation because of opposition to government control of water power. The TVA Act, which included Muscle Shoals in a plan for the development of the Tennessee River Valley, was finally passed in 1933 largely because of the efforts of Senator George W. Norris, after whom the first dam, completed in 1936, was named. The agency was immediately challenged by the private power companies which it replaced in the valley, but the United States Supreme Court upheld the right of the TVA to sell power. It has also met opposition from politicians who resented their inability to use it for political gain.

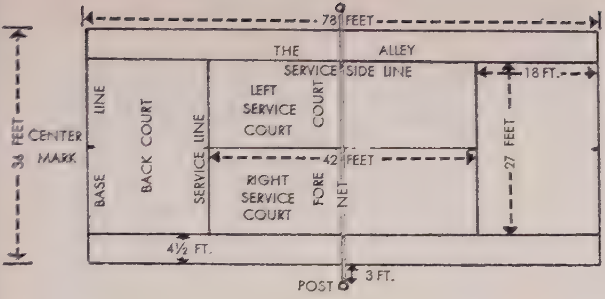
The *yardstick* principle, according to which the TVA's low rates were to determine electric rates throughout the valley, has also provoked controversy. Opponents contend that, since the TVA is financed from the Federal Treasury, to use its rates as the yardstick is unfair. In reply the TVA points to its net profits of many millions of dollars each year and contends that these profits will eventually repay both principal and interest on the original cost of its installations. Proposals have been made for extending the TVA concept to other rivers, especially the Missouri. See also CONSERVATION; MUSCLE SHOALS; TENNESSEE RIVER.

TENNIEL, *ten'yel,* SIR JOHN (1820-1914), famous cartoonist and illustrator, was born in London. From 1851 to 1901 he was on the staff of the humorous weekly *Punch,* doing many political cartoons and illustrations. He also illustrated many books; his drawings for *Alice in Wonderland* and *Through the Looking-Glass* created an indelible impression on generations of readers.

TEN'NIS, a game in which the players use rackets to hit a ball back and forth across a net, probably originated in France during the Middle Ages. Among the many modern versions of the game, *lawn tennis* is the most popular, although court tennis, paddle tennis, racquets, squash racquets, and table tennis (Ping-pong) are also played by many people.

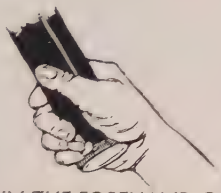
Lawn Tennis may be played on an outdoor or an indoor court with a smooth surface of grass, asphalt, clay, concrete, or composition. The dimensions and the layout of the court are shown in the diagram. The net that is stretched across the middle of the court is three feet high in the center and about three and a half feet high at each end. Tennis balls, made of inflated rubber covered with felt, are about two and a half inches in diameter. The rackets have wooden frames approximately eight by fifteen inches in size, strung tightly with tough silk, gut, or nylon.

A game begins with a *service*. The server, standing behind the baseline, smashes the ball across the net into the receiver's right-hand service court. If the ball goes into the net or fails to land in the service court, it is counted as a *fault*. The server has a second chance, but a *double fault* gives the point to

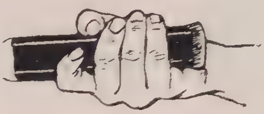


TENNIS

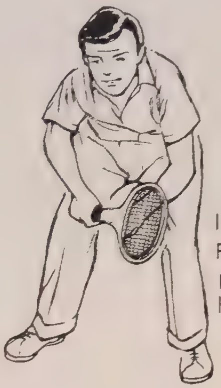
THE SIDE LINES FOR SINGLES, in which two players take part, lie inside the side lines for doubles, in which four players take part. The base lines of the court are the same for both games.



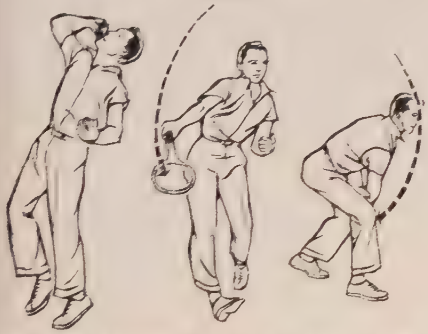
IN THE FOREHAND GRIP, Eastern style, the player "shakes hands" with the racket.



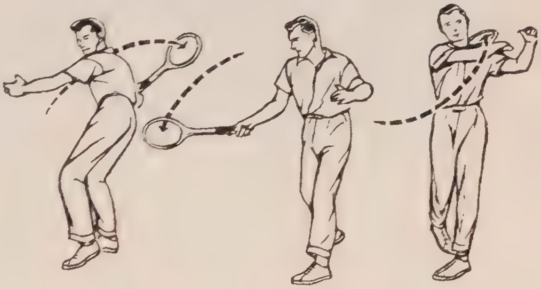
IN THE WESTERN GRIP for the forehand the racket is held farther back in the palm.



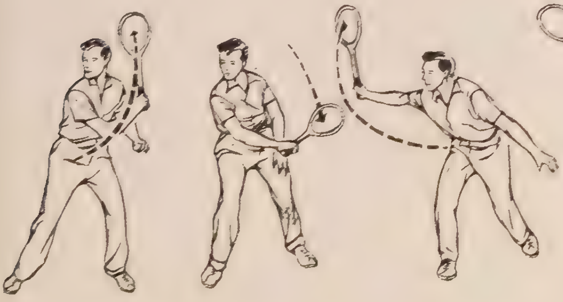
IN THE READY POSITION a player awaits his opponent's stroke.



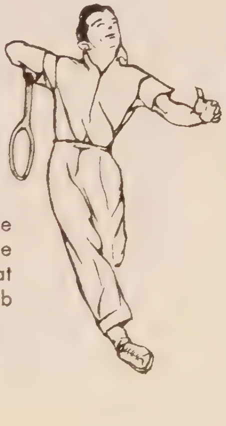
IN THE FLAT SERVE the ball is tossed up, the racket is swung high to strike it as it begins to drop, and the arm is brought down and across the player's body in the follow through.



IN THE FOREHAND DRIVE the player begins his stroke standing at right angles to the net and ends it facing the net.



IN THE BACKHAND DRIVE the player draws his racket back from waist level to shoulder height, swings it forward to waist level to meet the ball, and lifts it high once more in the follow through.



IN THE VOLLEY (above) the player hits the ball before it bounces. In the smash (at right) he brings down a lob with an overhead swing.

his opponent. A fair service must be returned on the first bounce; once the ball is in play, however, it may be hit in the air (a *volley*) or on the first bounce. A player wins a point when his opponent fails to return the ball or sends it into the net or out of bounds. After the first point, the server shifts to the left side of the baseline and serves into the left-hand service court. He continues to serve until the game is over; in the next game his opponent is the server.

In scoring, the first two points count fifteen, the third ten, and the fourth wins the game. The server calls the score at the beginning of each point, giving his own score first. Instead of zero, the word *love* is used, as *fifteen-love, thirty-love.* A contest tied at 40-40, or *deuce,* is a deuce game, and a player must score two points in succession in order to win. A one-point lead in a deuce game is an *advantage;* and the server calls "Advantage in" if the point is his, "Advantage out" if it is his opponent's. The first player to win six games while his opponent has no more than four, takes the *set.* If the set is tied at five games each, it continues until one player wins two games in succession. In men's championship play, three out of five sets determine the winner; in women's play, two sets out of three. In a game of singles, there are only two players. *Doubles* play is similar to singles, but two people play on each side and the playing area is nine feet wider.

History of Tennis. Originally the French name for tennis was *jeu de paume,* or hand game, and it may be that early players used the palm of the hand instead of a racket; but rackets must have been adopted before the thirteenth century. An early form of tennis had a great vogue, particularly in France and England. For several hundred years the game was very popular, but strong competition led to betting, and eventually the sport was forbidden to the common people. The modern game of lawn tennis was introduced into the United States from England about 1874. The United States Lawn Tennis Association staged the first national championship in 1881. Modern topflight tennis competition centers about the Wimbledon tournament in England; the United States national championships; and the famous international matches for the Davis Cup, which was established in 1900 by Dwight F. Davis, an American tennis star. Teams of British and American women have played matches for the Wightman Cup since 1923.

Possibly the greatest tennis player the world has ever seen was William T. (Big Bill) Tilden, who won the American singles title seven times and won seventeen out of twenty-two Davis Cup matches. Other notable American men players were William Johnston, Ellsworth Vines, Donald Budge, Robert Riggs, and John Kramer. The greatest of the French players were Henri Cochet, René La Coste, and Jean Borotra. Fred Perry was the outstanding English player of modern times. The ranks of women stars include Helen Wills, seven times winner of the United States title, Helen Jacobs, and Alice Marble, all Americans, and the incomparable Suzanne Lenglen of France.

Many of the finest amateur players, after achieving fame in Davis Cup matches and other tournaments, turn professional. They compete in exhibition matches and conduct tournaments, but they are barred from all amateur contests.

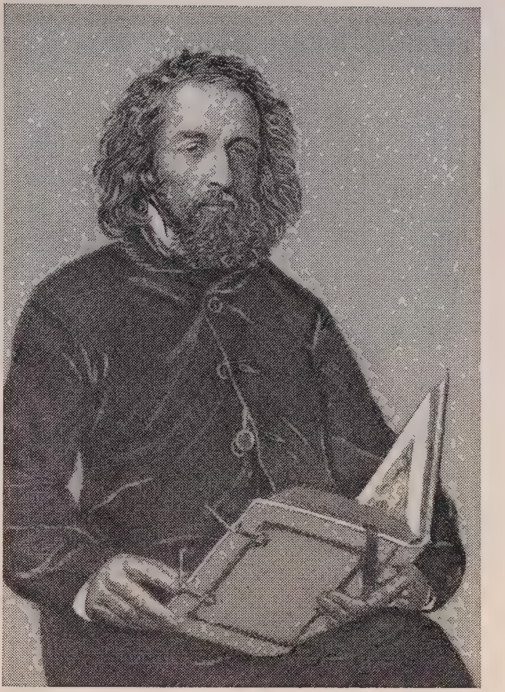
Court Tennis is an indoor game that was once called royal tennis. It is probably like the old game of tennis that the nobles of Europe played many centuries ago. Court tennis is played on a specially constructed court with walls of cement and a wooden shed that projects on three sides. The ball is played from the walls, from the shed, or penthouse, and on the ground. The balls and rackets are not exactly like those used in lawn tennis, and the rules of the game are also different. Court tennis is played mainly in a few exclusive clubs because building the court is an expensive process.

Paddle Tennis was devised in the early 1920's by Frank P. Beal, a young minister who wanted to teach tennis to the children who came to the recreation centers of New York. The court for paddle tennis is only half the size of a regulation tennis court, and the rackets used are light, wooden paddles. The ball, which is about the size of a tennis ball, is made of sponge rubber. Children took up the game with enthusiasm, and adults soon decided to try it. The senior court is larger, and the adults use heavier paddles. A further development of the game was *platform paddle tennis,* which is played on a walled and covered platform. Some platforms are movable, while others are set permanently in place. The back walls enter into the play, and the game is usually played by four rather than by two people. Community playgrounds in many cities have set up paddle-tennis courts. The United States Paddle Tennis Association was organized in 1938. See also TABLE TENNIS.

TENNYSON, *ten'ih s'n,* ALFRED, FIRST BARON TENNYSON (1809-1892), English poet of the Victorian Period, expressed the attitudes and emotions of his countrymen with grace and accuracy throughout his long and distinguished career. He was the best-loved poet of his time, and today he is considered the most representative of Victorian authors. He was born in his father's rectory at Somersby, Lincolnshire, and spent a happy childhood there with his brothers and sisters. His early attempts at verse, published in *Poems by Two Brothers* (1827), revealed his fondness for romantic poetry but showed no special promise. In 1828 he entered Trinity College, Cambridge, where he formed a close friendship with Arthur Henry Hallam. The next year Tennyson won the Chancellor's prize for poetry with *Timbuctoo,* a poem in blank verse, and in 1830 he published his first independent volume, *Poems, Chiefly Lyrical,* a slight improvement over his earlier work.

Growing Recognition and Maturity. Tennyson left Cambridge in 1831, and the following year he published *Poems,* containing such excellent pieces as "The Lady of Shalott," "The Lotos-Eaters," "Oenone," and "The Palace of Art." Critical approval was by no means unanimous, but the beauty and charm of the work received some recognition. Then, in 1833, the death of Arthur Hallam brought the most profound emotional shock which Tennyson ever experienced. His health suffered, and his religious faith was severely shaken. For ten years he published nothing, although he continued to write. *In Memoriam,* begun during this period, records his struggle against doubt and despair, his gradual development toward full maturity, and his final acceptance of a philosophy based on faith. This magnificent elegy, published in 1850, is more than an expression of personal grief; it reflects the mental and moral conflicts of an age in which new scientific discoveries seemed to be destroying the religious teachings of the past and offering nothing in their place.

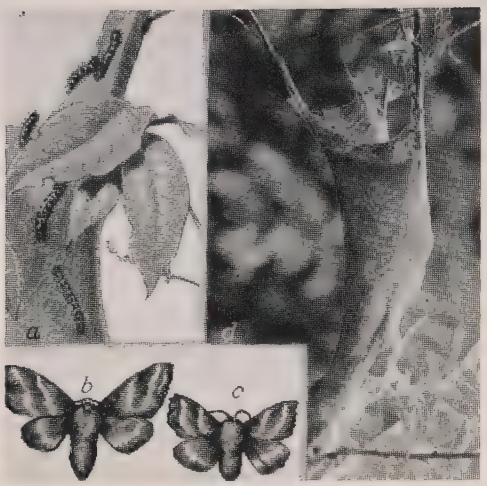
In 1842 Tennyson published two volumes which gained immediate popularity. This edition of *Poems* contained "Ulysses," "Morte d'Arthur," "Locksley Hall," and "Break, Break, Break." It was followed by *The Princess* (1847), in which some of Tennyson's loveliest songs are included. In 1850 Tennyson succeeded Wordsworth as Poet Laureate, and his many years of financial worries came to an end. He filled the post with great success, although, with a few exceptions like "Ode on the Death of the Duke of Wellington" (1852), the poems he wrote in his official capacity are not highly regarded today. Patriotic verse like "The Charge of the Light Brigade" (1854) won tremendous popularity, and his *Idylls of the King* was hailed throughout the nation. This series of narrative poems, published between 1859 and 1885, is colorful, melodious, and dramatic, but the knights and ladies who frequent King Arthur's court in Tennyson's version have little resemblance to the lusty, violent characters of the ancient Arthurian legend. Other works in this period include the lengthy narrative, *Maud* (1855), the sentimental tale of *Enoch Arden* (1864), and the dialect poems, "Northern Farmer: Old Style" (1864) and "New Style" (1869). Tennyson also attempted a number of historical tragedies, of which *Becket* (1884) achieved some success.



LORD TENNYSON, Poet Laureate of Victorian England, was the spokesman for an age of material progress and spiritual unrest.

Memorable among Tennyson's later works are "Locksley Hall Sixty Years After" (1886) and "Crossing the Bar" (1889), one of the best-loved poems of all he wrote. In the second "Locksley Hall" poem, he again expressed the sentiments of many of his countrymen when he charged that the rich promise of the Victorian Age had never been fulfilled. His death was mourned both at home and abroad, and his body was placed in Westminster Abbey.

Estimate of His Poetry. To his contemporaries, Tennyson was the ideal poet: serious, virtuous, sincere, devoted to public service, capable of producing graceful rhythms and of expressing lofty sentiments. Thus, his gifts and his character were perfectly suited to his age. For that very reason, his reputation diminished in the early twentieth century, when all things Victorian were treated with scorn. Today his faults of superficial prettiness and weak sentimentality are recognized, but he is given full credit for his great metrical skill, his honest emotion, the sensuous beauty of his early poems, and the perfection of such splendid lyrics as "Sweet and Low," "The Splendour Falls on Castle Walls," "Tears, Idle Tears," "Ask Me No More," and "O That 'Twere Possible."



FULL-GROWN TENT CATERPILLARS are shown at the upper left (a). Below them are the female moth (b) and the male moth (c). At the right is the caterpillar tent (d).

TENSE. See Language and Grammar.

TENT. See Camps and Camping.

TENT CATERPILLAR, the larval form of certain silk-spinning moths. One of the best-known species of North America is the *apple* tent caterpillar, which attacks apple, wild cherry, and related fruit trees. The adult female, a dull reddish-brown moth with two oblique pale stripes on the forewings, lays between 200 and 300 eggs during the summer. These are deposited in rings or belts around small twigs and are firmly cemented together. The following spring the eggs hatch into two-inch, black larvae, or caterpillars, marked with a white stripe down the back and blue and white spots on the sides. The caterpillars spin a tentlike web in the crotch of a branch and remain within the shelter of this web except when feeding during the morning and afternoon. They are so ravenous that the occupants of a single tent can destroy thousands of leaves within a short time. About six weeks after hatching, each caterpillar settles down and spins a silken cocoon about itself. Three weeks later the adult moth emerges, and soon after the eggs for the next year's brood are laid.

Tent caterpillars may be destroyed by burning the tent or by spraying it with lead arsenate; this should be done, however, while the caterpillars are within the web. Eggs can be collected and destroyed during the winter. Many eggs are eaten by birds, and great numbers of caterpillars are killed by parasites. The *forest* tent caterpillar, which commonly infests maple and other trees, is a close relative of the apple tent caterpillar but does not spin a tent. Masses of these caterpillars can also be destroyed by burning or spraying.

Scientific Names. Apple tent caterpillar, *Malacosoma americana;* forest tent caterpillar, *M. disstria.*

TENURE OF OFFICE ACT, an act passed by the United States Congress to restrict the President's power to remove officials. It was enacted over President Johnson's veto during the bitter controversy over Reconstruction and was designed to prevent the President from removing Republican officeholders. The law provided that, in order to remove any officials appointed with the consent of the Senate, the President must obtain the consent of that body. The Constitution makes no statement as to the removal of Federal officials, but prior to 1867 the Presidents had exercised full authority in ousting officeholders. President Johnson contended that the Tenure of Office Act was unconstitutional; he therefore defied Congress by removing Secretary of War Edwin Stanton, who had supported the Reconstruction policy of Congress. Johnson was thereupon impeached but escaped conviction by a single vote. Most parts of the law were repealed soon after Johnson's term expired, and the act was entirely repealed in 1887. In 1926 the United States Supreme Court decided that the President has full authority in removing "executive officers." See Johnson, Andrew.

TEPEE, or **TIPI**, *te'pee,* a Sioux word for dwelling. The term is generally applied to the tall, conical tent, covered usually with skin, which was the specialty of the wandering Plains tribes of Indians. The tepee was always put up by women, who sewed its immense cover out of twelve or more buffalo hides. In erecting the tepee, they first made a support of three or four especially tall poles, with the forked tops interlacing. Other poles were then leaned against these to form a cone, the base of which might be twenty-five feet in diameter.

The cover, shaped like half or two thirds of a circle, was then raised on two poles, and its edges were laced together down the front of the tepee, with a slit left for the door. The laced edges stopped short of the top, so that an opening could be left as a smoke hole. They ended in two extensions called the "ears," which could be moved by poles to keep the wind from blowing down the smoke hole. When the family moved, the tepee poles were dragged behind the horses as "travois" (carrying frames) for the tepee cover and other household equipment.

Algonquian tribes in Maine and eastern Canada also used the cone-shaped tent, but with them it was cruder and covered with birchbark. The Shoshone, beyond the Rockies, made it of deer hide. See also Indians, American; Wigwam.

TERBIUM, *tur'bih um,* a rare metallic element discovered in 1843 by Mosander, is one of a group of elements known as the rare earths (see Periodic Table). Terbium occurs in such minerals as gadolinite, samarskite, euxenite, and monazite. The symbol is Tb, the atomic weight 159.2, and the atomic number 65. Terbium forms a white oxide, Tb_2O_3, and several crystalline salts. It is one of the scarcest of the elements and is of no commercial importance.

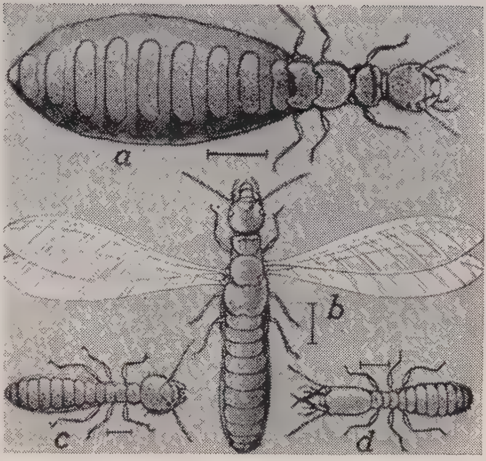
TEREDO, *teh re′doh,* or **SHIPWORM**, a marine mollusk that burrows into wood, causing tremendous damage to wooden wharf pilings and ships. Though its elongated body resembles that of a worm, the shipworm is nevertheless a true mollusk related to the clams. Its shell, which is divided into halves, or valves, covers only a small part of the front end of the body and is equipped with toothed edges for tunneling through wood. At the rear end of the body, two siphons draw in a current of sea water, which supplies the shipworm with oxygen. The microorganisms contained in the water also provide part of the animal's food, the remainder of its nourishment being obtained from the wood. The common shipworm usually measures less than a foot in length, but six-foot species have been found in tropical waters. Wood may be protected from shipworms by treatment with creosote.

Scientific Name. Common shipworm, *Teredo navalis.*

TER′ENCE, full name Publius Terentius Afer (about 195-159 B.C.), was a celebrated Roman dramatist. According to the Latin biographer Suetonius, he was born a slave in Carthage and was brought to Rome by a Senator who educated him and gave him his freedom. Terence borrowed freely from the Greek writers of comedy, especially Menander, but he changed the plays and adapted them to his own dramatic purposes. His first play, *Andria (The Woman of Andros),* which was produced in 166 B.C., was a free adaptation of a play with the same title by Menander. The other comedies that have survived are *The Eunuch, The Mother-in-Law, The Self-Tormentor, Phormio,* and *Adelphi (The Brothers).* In 160 or 159 B.C., Terence went to Greece and probably died there.

TERE′SA, Saint. See Theresa, Saint.

TER′MITES, a group of social insects comprising the order Isoptera, are known for the extensive damage they cause to trees and wooden structures. Although unrelated to the true ants, termites are commonly called *white ants.* They are found in all parts of the world, except for the Arctic and Antarctic, and are especially abundant in the tropics. Of the more than 1,900 known species, about fifty occur in America north of Mexico. Some termites live beneath the ground and build tunnels to communicate with wooden objects nearby; others simply burrow in wood above ground. Certain tropical species, notably those in Africa, build moundlike nests on the ground, reaching from ten to twenty feet high; others build round nests in trees.

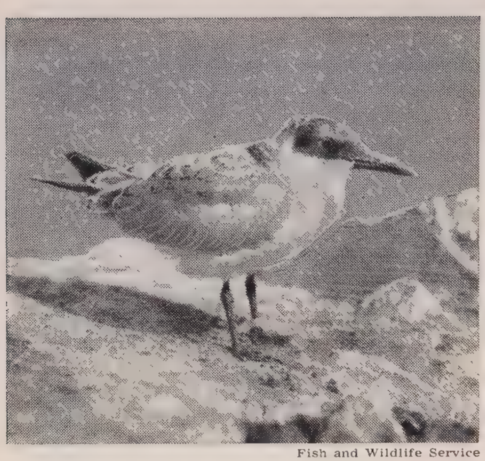


THE FEMALE TERMITE, distended with eggs, is shown at the top (a). In the center is the male (b), at lower left the worker (c), and at lower right the soldier (d). Beside each insect is a bar indicating its actual size.

Like other social insects, termites live in colonies. In most species there are four castes — first and second reproductive castes, workers, and soldiers. Termites of the first reproductive caste are black males and females with wings half again as long as the body. At swarming time, they leave the nest and fly about for a short time. Then they alight, shed their wings, and mate. Each pair of termites, known as the *king* and *queen,* founds a new colony. They remain together within the nest for the rest of their lives, the female producing thousands of eggs each month. These hatch into *nymphs,* which resemble miniature adults and gradually develop into workers, reproductives, and soldiers. Should the king or queen die, they are replaced by the second reproductives, pale-bodied termites that look like nymphs with wing buds but are capable of reproducing.

The workers are responsible for feeding the other members of the colony, caring for the eggs and young, enlarging the nest, and building tunnels. They are grayish white in color and are blind and wingless. Some species lack a worker caste, the tasks of this group being taken over by the young reproductives. Soldier termites resemble workers in general appearance but have enormous heads and jaws for defending the colony.

Although most termites feed on wood, they are incapable of digesting the wood themselves. This is done for them by certain microscopic one-celled animals (protozoans) that



Fish and Wildlife Service

LARGEST OF THE TERNS is the Caspian tern, which may have a wingspread of fifty-five inches.

live in their intestinal tracts. The wood-boring activities of termites are responsible for millions of dollars' worth of damage every year to buildings, trees, telephone poles, furniture, and various other wood products; sometimes books and foodstuffs are also attacked. Very often an entire structure is undermined before the presence of termites is detected. To prevent termite damage the United States Government recommends destroying the nests with chemicals, substituting concrete or brick for wood foundations, and using building lumber that is naturally or artificially termite resistant. In regions where termites are prevalent, it is wise to have houses inspected periodically. See also INSECTS.

TERN, *turn,* a slender, long-winged bird related to the gulls (see GULL). The terns are from nine to twenty-three inches long, and their color ranges from pure white to sooty black. They are very swift, graceful, and tireless in flight; in migration some species cover tremendous distances. Web-footed, the terns swim well and dive to catch small fish. In the breeding season they live in great colonies on the sandy beaches of the northern sea islands or in inland swamps.

The widely distributed *common* tern is a slender white bird about fifteen inches long, with a black cap, a red bill tipped with black, and a forked tail. A pale-gray mantle covers the back and wings. The gentle *fairy* tern of the Pacific atolls is pure white, with large, dark eyes. It lays a single egg, precariously balanced on a branch or in the fork between two twigs. The *Arctic* tern, similar to the common tern but with a longer tail and a rose-red bill, breeds in the northern part of the Northern Hemisphere. In the winter it is found in the Antarctic, as much as eleven thousand miles from its breeding grounds. It is believed that the Arctic terns which breed in North America cross the Atlantic and follow the coasts of Europe and Africa to the south. Throughout the year they are always where the daylight hours are longest. No other creature known has such a wide north-south range.

Scientific Names. Common tern, *Sterna hirundo;* Arctic, *S. paradisaea;* fairy, *Gygis alba.*

TERPSICHORE, *turp sik'oh ree.* See MUSES.

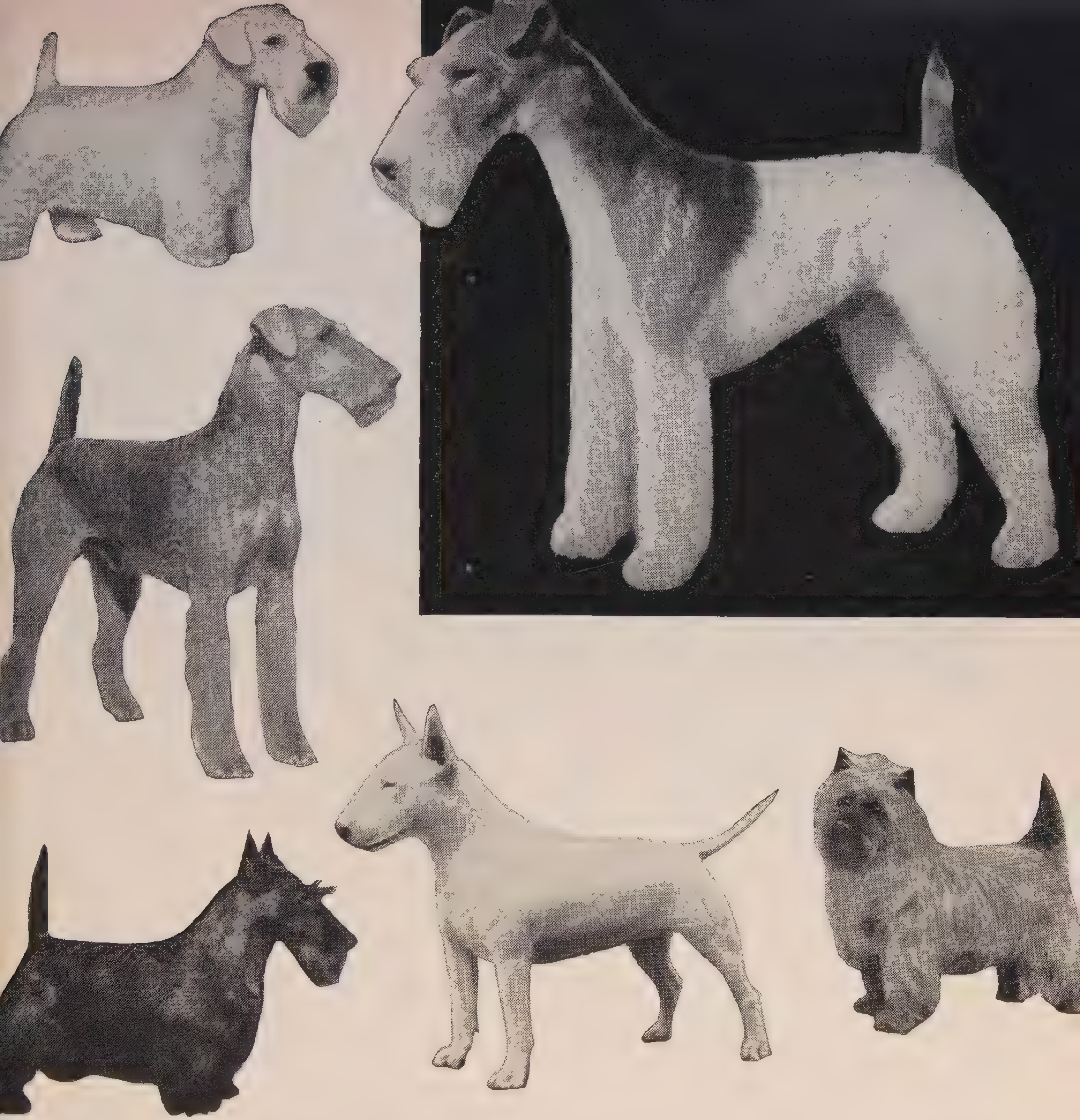
TER'RA COT'TA is hard-baked clay; the Italian words mean *baked earth.* The natural color of the clay is generally a reddish brown. Terra cotta has been used since prehistoric times for vases, architectural decorations, tiles, figurines, and occasionally large statues. Many little terra-cotta figures have been found in early tombs. Such statuettes were either modeled or formed in a mold; some were glazed and painted. Terra-cotta figurines were made in Tanagra, Greece, from the fourth to the second century B.C. During the Renaissance very beautiful terra-cotta reliefs, enameled in brilliant colors, were done by Italian sculptors. Members of the Della Robbia family were masters of this art (see ROBBIA, DELLA).

The chief use of terra cotta has been in architecture, especially in regions where building stone is scarce. Ornamental moldings, cornices, gutters, and tiles for roofing can be made in sections and set into place. In the process of firing, terra cotta shrinks about one inch for every foot, and allowance must be made for this shrinkage.

TERRAPIN, *tehr'uh pin,* an aquatic or semiaquatic turtle inhabiting ponds, swamps, and rivers in the temperate parts of the world. The various species of terrapins range from six to fourteen inches in length and have a circular, arched upper shell, which is usually black or brownish but in a few species is marked with red or yellow. Terrapins are able to get about as easily on land as in water. Some are edible and therefore of market value, particularly the *diamondback* terrapin of the Atlantic salt marshes. This three-pound species can be identified by the circular grooves in the shields of its upper shell. Though wild diamondbacks are now rarely seen, many are raised for market on terrapin "farms." See also TURTLE.

Scientific Name. *Malaclemys centrata.*

TERRE HAUTE, *tehr eh hote',* IND., is the commercial and industrial center of the Wabash Valley and headquarters for a rich coal-mining region. It is the seat of Vigo County. The city lies seventy-two miles southwest of Indianapolis, occupying two square miles of plateau on the east bank of the Wabash River. Its name is the French for *high ground.* Mushrooms, tomatoes, and cucumbers are grown here in the world's largest vegetable gardens under glass. Breweries, food-processing plants, and one of the world's



Dog World

AN ASSORTMENT OF TERRIERS includes the Sealyham terrier (top left), the wire-haired fox terrier (top right), the Airedale terrier (center left), the Scottish terrier (bottom left), the bull terrier (center bottom), and the cairn terrier (bottom right).

largest distilleries are the most important industrial establishments. Drugs, paper and box goods, glass, steel, and enameling and stamping products also are manufactured. A large plant producing penicillin is located in Terre Haute. The city is served by four trunk-line railroads. Terre Haute is the seat of Indiana State Teachers College, Rose Polytechnic Institute, and St. Mary-of-the-Woods College for Women. Cultural activity also centers in the Community Theater and various music groups. Parks cover 540 acres.

General William Henry Harrison, in 1811, built the fort which bears his name, and around it the first settlement developed. The present city was platted in 1816 and incorporated as a city in 1853. Among Terre Haute's citizens have been President Zachary Taylor, commander of the first fort; Eugene V. Debs, labor leader; Theodore Dreiser, novelist; Janet Scudder, sculptor; Max Ehrman, poet; and Claude Bowers, diplomat and historian. The population exceeds 64,000.

TER′RIER, any one of a group of small and medium-sized dogs, noted for their liveliness, courage, and adaptability as house pets. The name is taken from the Latin *terra,* meaning *earth,* and refers to the terrier's skill in burrowing into the ground for such prey as rats and badgers. The terrier group is one of the six major classifications recognized by the American Kennel Club. About

The Bettmann Archive

IN CARTS CALLED TUMBRELS the Royalists of France were hauled past jeering spectators to the guillotine during the Reign of Terror.

twenty breeds are recognized; the best known of the group are the Airedale, Bedlington, bull, cairn, Dandie Dinmont, fox, Irish, Kerry blue, Manchester, schnauzer, Scottish, Sealyham, Skye, and Welsh terriers. The size, length of coat, and color markings vary considerably according to the prescribed standard for each breed. See also Airedale Terrier; Bull Terrier; Cairn Terrier; Dog; Fox Terrier; Scottish Terrier; Sealyham; Skye Terrier.

TER′RITORY, in the United States, an organized area of the national domain which has some measure of autonomy but does not have the full self-government possessed by the states of the Union. A territory may control most of its own affairs, but Congress has the ultimate authority. When Congress admits a territory to the Union, however, the new state gains full equality with the older states. Most American states were territories before they were granted statehood. Hawaii and Alaska, the only remaining territories, applied for statehood in 1940 and 1946 respectively. Each has an elected legislature and is represented in the United States House of Representatives by one delegate, who may debate but not vote. The President appoints territorial governors and judges.

TER′ROR, Reign of, the term usually applied to the period of the French Revolution from the appointment of the Revolutionary Tribunal and the Committee of Public Safety, in April, 1793, to the fall of Robespierre in July, 1794. The purpose of the Terror was to bring stability and order by ruthless extermination of all opposition tending to weaken French unity. Danton and Robespierre, the strong men of the Terror, had hundreds of persons put to death on the guillotine. When Danton urged moderation, he, too, was executed, and Robespierre was supreme until the inevitable reaction and his death. See also Danton, Georges Jacques; French Revolution; Robespierre, Maximilien Marie Isidore.

TERTIARY, *tur′shih ehr ih*, **PERIOD**, a name given to the first part of the Cenozoic, or modern, Era of geologic history. The Tertiary Period is generally divided into four epochs: the Eocene (earliest of the four), Oligocene, Miocene, and Pliocene. (See the chart *Chronology of Geologic History* in the article Geology.) The term Tertiary is often used in modern geology in reference to the rocks that were formed during these epochs. In Texas and Louisiana the layers of Tertiary rocks are estimated to be six miles in depth. More than half the oil taken from the earth has come from Tertiary formations. See also Cenozoic Era; Geology.

TES′LA, Nikola (1856-1943), American electrician and inventor, is best known for the invention of an induction motor (1888) which first made possible the use of alternating current instead of direct current. Tesla was born in Croatia (Yugoslavia) and in 1884 came to the United States, where he was naturalized. He worked for a few years with Thomas A. Edison, at Orange, N. J., and then opened his own laboratories in New York City. In the field of high-tension electricity he perfected the Tesla coil, a generator and transformer of high-frequency currents. He designed the apparatus used in the great power plant at Niagara Falls; made many improvements in dynamos, arc lamps, and incandescent lights; and worked out a system of wireless communication and one of wireless transmission of power.

TEST ACTS, a series of acts passed by the English Parliament in 1661, 1672, and 1678 to exclude Roman Catholics and Protestant nonconformists from public office and public employment. The Corporation Act of 1661 required all magistrates to take the oaths of allegiance and supremacy and to receive communion according to the rites of the Church of England. The 1672 act extended these tests to persons in public employment; the 1678 act, to members of Parliament. These acts were modified in 1689 and finally abolished by the Catholic Emancipation Act of 1829. See also NONCONFORMISTS; TOLERATION ACT.

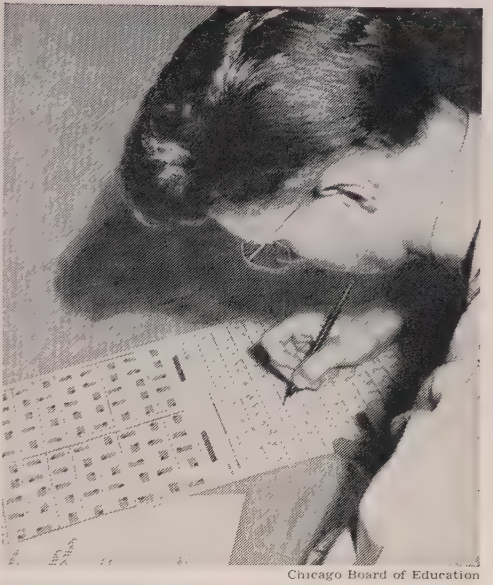
TESTES, *tes'teez.* See GLANDS, *Reproductive Organs.*

TESTS AND MEASUREMENTS. Throughout the ages man has attempted to describe the feelings, the mental abilities, and the behavior and performances of his fellows by comparing one with another. Tests and measurements are tools to aid him in making more accurate observations, comparisons, and predictions, and also in indicating the ways in which he might make more satisfactory use of his abilities.

Types of Tests

Educational Achievement Tests are used to measure the amount and quality of knowledge learned in a course of study. Some are primarily diagnostic; that is, they reveal special weaknesses, such as difficulties in reading or arithmetic. The essay test, commonly used in the past, has been supplemented with the more objective type, in which a student makes a choice between alternative answers or completes a statement by inserting a word or phrase. The objective type eliminates the personal judgment of individual teachers or examiners in grading the test. In some cases these tests are scored by machines. Information from achievement tests is used in several ways: to group students for instruction according to their progress, while individual weaknesses are given special attention; to improve courses and teaching methods; and to select students for further education in various fields.

Intelligence Tests investigate mental abilities. An ideal test measures the abilities of individuals regardless of environmental differences. The effort is to make a test in such a way that the scores of a college graduate and a person with little formal training will not be affected by the differences in their educational background.



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TESTS INVOLVING SHAPES, FORMS, AND SYMBOLS as well as words are used in measuring general mental abilities.

Tests may be constructed for individual or for group use. In either case, they may be *verbal,* calling for language answers, or *nonverbal,* comprised of objects to be manipulated and tasks to be performed. The nonverbal, or performance, tests, are often used with persons with language difficulties due to foreign birth or to physical handicaps.

Alfred Binet, whose work has fundamentally influenced modern psychological testing, believed that intelligence is a complex, interrelated function. One type of test, based directly on his theory, is devised to study intelligence not in parts but as a whole; it gives one score and one quotient (see INTELLIGENCE QUOTIENT). Another type, related to the Binet test, includes both verbal and performance items. These two groups of items are scored separately; a total score may also be obtained. A third type is based on the theory of the psychologist Louis Leon Thurstone that intelligence is a product of several primary factors. Each factor, such as the verbal, the quantitative, and the spatial, is tested alone, and the part scores are then related to each other in an outline of mental abilities, or mental profile, showing how far above or below the average the person has scored in each factor.

Aptitude Tests and Interest Inventories. *Aptitude tests* indicate the areas in which an individual might be successful with training. Relatively simple functions, such as eye efficiency, are investigated. Combinations of

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PERFORMANCE TESTS ARE CAREFULLY TIMED so that the scores can be correctly evaluated by the experienced examiners.

traits and functions are studied in the mechanical-aptitude tests, and more complex and less well-defined formations in the aptitude tests for law or medicine. Some tests are constructed to indicate possible success in school and school subjects; reading-readiness tests for little children and foreign-language aptitude tests are examples. Others are more directly applied to vocational placement and personnel selection, such as clerical-aptitude tests. *Interest inventories* are commonly used to supplement the results of personal interviews and aptitude tests. An individual's interests as studied by these inventories may help him decide as to the future development of one of several aptitudes which he may have.

Personality Tests. Measuring traits of personality is difficult, and the results must be viewed with caution even when interpreted by experienced people who are aware of the strengths and weaknesses of the tests. Rating scales, in which one individual is rated by others, and personality inventories, which are primarily self-rating questionnaires, are two familiar methods by which opinions, attitudes, and traits of character are investigated. However, these tests never fully reveal one's personality characteristics; and so increased attention is being given to other techniques, including the less precise *projection* methods, in which a trained observer attempts to interpret an individual's responses to anecdotes, pictures, or ink blots. Other tests and situations have been devised which study one person in relation to another and also the activities of an individual in a group.

Applications. Psychological tests have a limited use in schools, industries, vocational and guidance clinics, and the armed forces, to indicate the extent and kind of further education or special training an individual might profitably pursue. A few industries use test results to supplement the experience record and the personal interview in hiring employees and in choosing workers for special assignments or for promotion. They also use tests to rate men on their jobs and to uncover hidden talents and unsuspected uses of talents, as well as emotional difficulties which reduce productivity. Knowledge about achievements in the past, potential abilities, personality traits, and general intelligence is important in helping and guiding an individual both in school and in a career.

Constructing a Test

Standardizing a test includes eliminating those items which may give one individual a better chance than another and requires careful checking and revising. Any test, whether it proposes to measure a specific aptitude or general intelligence, must also be checked for two things: (1) *reliability,* the extent to which it gives consistent results; and (2) *validity,* the accuracy with which it actually measures what it has set out to measure. Finally a *norm,* the average score of a typical group in regard to a specific characteristic, is established. This norm is then used in later testings to place an individual in relation to his group.

TETANUS, *tet'uh nus,* or **LOCKJAW**, an infectious disease afflicting man and most warm-blooded animals. It is caused by certain bacteria which are widely distributed in the soil and are found in other objects contaminated with human and animal feces. The bacteria gain entrance to the body through wounds resulting from nail punctures, embedded splinters, compound fractures, gunshots, insect bites, burns, and even minor abrasions. Within the body, they grow and produce a toxin, or poison, which affects the nerves and muscles.

The earliest symptoms of tetanus are stiffness of the jaw and neck, restlessness, and difficulty in swallowing. Later, the victim's jaws become more or less locked together, and the muscles of his face, neck, back, and abdomen are thrown into a state of persistent contraction. Since tetanus may end fatally, medical aid should be sought immediately. Treatment consists in administering antitoxin to combat the bacterial poisons, opening and cleansing the wound, and administering sedatives. Immunity to the disease may be acquired by means of tetanus toxoid injections, followed at one- or two-year intervals by *booster* injections. See also IMMUNITY.

TET'ANY, a condition in which the muscles and nervous system become highly sensitive, resulting in muscle spasms and convulsions. Tetany is found most frequently in children between the ages of three months and two years, and less often in adults. It occurs when the amount of calcium in the blood falls below normal, and it is commonly brought on by a deficiency of parathyroid hormone, a lack of calcium in the diet, overexcretion of calcium from the body, vitamin D deficiency, or alkalosis. Treatment of tetany includes the administering of drugs to quiet the convulsions, the replacement of calcium in the blood by means of calcium salts, and control of the underlying disease.

TE'TON INDIANS. See SIOUX.

TET'ZEL, JOHANN (1460-1519), the chief opponent of Martin Luther at the beginning of the Reformation, was a German monk of the Dominican Order (see REFORMATION). He was born in Saxony and educated at the University of Leipzig, joining the Dominicans soon after his graduation. An eloquent and forceful preacher, Tetzel was entrusted with the proclamation of an indulgence on behalf of the Teutonic Knights from 1503 to 1510. Again in 1516 he was given a similar mission for the purpose of raising money to complete St. Peter's Church in Rome. It was in connection with this mission that Tetzel aroused the opposition of Luther, whose famous ninety-five theses were directed against Tetzel and his methods. Tetzel's published reply contained language which the Church considered intemperate, and he was severely reprimanded by the Papal legate.

TEUTONIC, *tyu ton'ik,* **KNIGHTS**, or **TEUTONIC ORDER**, a militant religious order formed in Palestine in 1190 during the Third Crusade (see CRUSADES). It was founded by German merchants to give relief to sufferers during the siege of Acre. Eight years later its members were given the rank of knights, and it became predominantly an order for the German nobility. In the thirteenth century the order began a crusade to bring Christianity into heathen Prussia. The Knights rapidly conquered the Baltic countries, built fortresses, and established themselves as the ruling class with a court at Marienburg. But in the fifteenth century West Prussia was wrested from the Knights by Poland. In 1525 the Grand Master of the order, who was a member of the Hohenzollern family, became a Protestant and made East Prussia a hereditary duchy of his family under Polish sovereignty. The electors of Brandenburg took over the territory in 1618. The remaining possessions of the Knights in Germany were confiscated by Napoleon in 1809. Later in the nineteenth century the order was revived in Austria as an honorary organization.

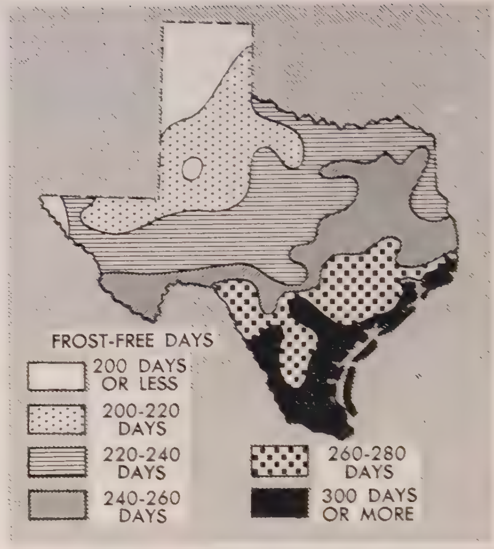
TEU'TONS, a Germanic tribe that invaded the Italian peninsula unsuccessfully in the second century B.C. The word Teutonic came to be used for Germanic groups in general. See also GERMANIC PEOPLES.

TEXAS, the "Lone Star State," is the largest state of the American Union, covering more than one eleventh of the area of continental United States. It is one of the richest political subdivisions in the world, its natural resources comparing favorably with those of many a sovereign nation. Indeed, Texas was an independent republic when it was admitted to the Union (1845), a distinction that can be shared only by Vermont. Texas alone among the states can look back on a history under the flags of six nations — Spain, France, Mexico, the Republic of Texas, the Confederacy, and the United States. Sam Houston, Stephen F. Austin, James Bowie, David Crockett, and William B. Travis are still revered for the tradition of heroism and statesmanship which they established during the Texas Revolution in 1835-36. Throughout its history the state has played a vital part in the development of both the South and Southwest and has contributed immensely to the economic prosperity of the United States.

The Land and Its Aspects

Location and Surface Features. Texas is bounded by New Mexico on the west, Oklahoma on the north, and Arkansas and Louisiana on the east. To the southeast is the Gulf of Mexico, and to the southwest the Republic of Mexico. The state also possesses natural boundaries in three rivers — the Red on the north, the Sabine on the east, and the Rio Grande on the southwest. With the exception of Florida, Texas extends the farthest south of any state. Because of the variety of its surface features, it is divided into four major regions and several minor sections.

Coastal Plain. The first and largest of the natural regions is the Coastal Plain, which extends inland from the Gulf of Mexico to the vicinity of Waco and Austin. It contains five subdivisions, the southernmost of which is the Rio Grande Embayment, between the Rio Grande and the San Antonio River, where rich agricultural districts have been developed. Between the San Antonio and Sabine rivers lies the Coastal Prairie, which, although it continues to afford pasturage for cattle, is best known today for its enormous yields of sulfur and petroleum. The three northern sections of the Coastal Plain are known as the Blacklands (from their fertile, black soil) and as the Post Oak and Pine belts (from their wealth of Southern hardwoods and softwoods). The indenting bays and lining lagoons of the Coastal Plain receive the waters of a number of rivers, among which are the Neches, Trinity, Brazos, Colorado, San Antonio, and Nueces. The chief offshore islands are Galveston, Matagorda, St. Joseph, Mustang, and Padre.



THE GROWING SEASON in practically all sections of Texas lasts through at least six months of frost-free days.

North Central Plain. Northwest of the Coastal Plain lies the North Central Plain, the second natural region of Texas. Most of the region is a vast, rolling prairie, the only

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Total Area: 267,339 square miles, of which 3,695 square miles are inland water.

Rank in Size: First.

Population (1950): 7,711,194.

Density of Population: 28.84 persons per sq. mi.

Rank in Population: Sixth.

Chief Cities: Austin (capital, 131,964), Houston (594,321), Dallas (432,927), San Antonio (406,811), Fort Worth (277,047), El Paso (130,003), Corpus Christi (108,053), Beaumont (93,715), Waco (84,300), Amarillo (73,737), Lubbock (71,390), Wichita Falls (67,709), Galveston (65,898), Port Arthur (57,377), San Angelo (51,889), Laredo (51,694).

How Acquired: Annexation of the Texas Republic.

Date of Admission to Union: 1845.

Noted for: Agricultural products (cattle, cotton, rice, fruits, vegetables, wool, mohair); minerals (petroleum, natural gas, helium, sulfur); manufactures (oil-refinery products, chemicals, cottonseed products, synthetic rubber, canned goods, paper).

Nickname: The Lone Star State.

Flower: Bluebonnet.

Bird: Mockingbird.

Tree: Pecan.

Song: "Texas, Our Texas"; words by Gladys Yoakum Wright and William J. Marsh and music by William J. Marsh.

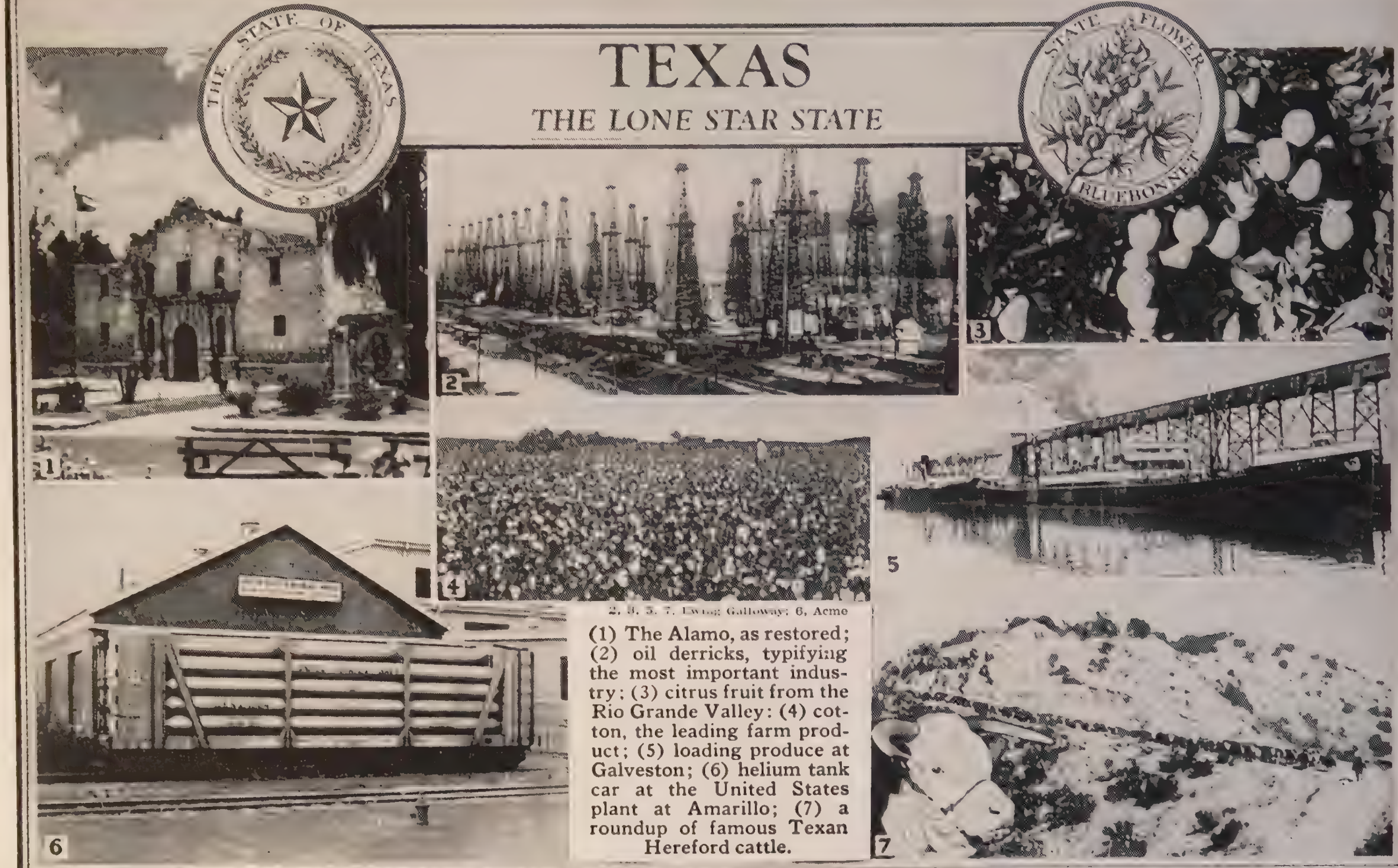
Motto: Friendship.

Seal: In the center of an azure ground is a five-pointed white star encircled by a wreath made of olive and live-oak branches. The outer circular border bears the words: The State of Texas.

Flag: Next to the staff is a blue, vertical stripe on which is centered a five-pointed white star; the remaining two thirds of the flag consists of two horizontal stripes of equal width, the upper one being white and the lower one red.

TEXAS

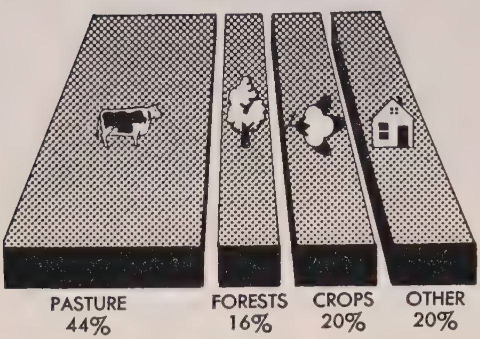
THE LONE STAR STATE



2, 3, 5, 7, Ewing Galloway; 6, Acme

(1) The Alamo, as restored; (2) oil derricks, typifying the most important industry; (3) citrus fruit from the Rio Grande Valley: (4) cotton, the leading farm product; (5) loading produce at Galveston; (6) helium tank car at the United States plant at Amarillo; (7) a roundup of famous Texan Hereford cattle.

LAND USE



VAST GRAZING LANDS, supporting millions of head of cattle, dominate the scene in the giant state of Texas.

exceptions being the eastern wooded belts, known as the East Cross and the West Cross timbers, and the hilly Burnet-Llano Area northwest of Austin, where huge masses of igneous rock (granite) are exposed.

The Great High Plain, beyond the North Central Plain, is the third natural region; from it the state slopes gradually southeastward. It is subdivided into the Panhandle Plain in the north, the Llano Estacado (Staked Plain) in the center, and the Edwards Plateau in the south. These grass-covered plains are drained principally by the Pecos and the Canadian River, a tributary of the Arkansas.

Trans-Pecos. The fourth natural region, called the Trans-Pecos because it occupies the western part of the state between the Rio Grande and its tributary, the Pecos, is a plateau crossed by several ranges of the Rocky Mountains. Guadalupe Peak (8,751 feet), in the Sacramento Mountains near the New Mexico border, is the highest point in Texas. In the western part of the Trans-Pecos is the Big Bend National Park, a scenic, primitive area surrounding the great bend of the Rio Grande. Much of the eastern part of the region is a desert, its monotony relieved by colorful buttes, mesas, and canyons.

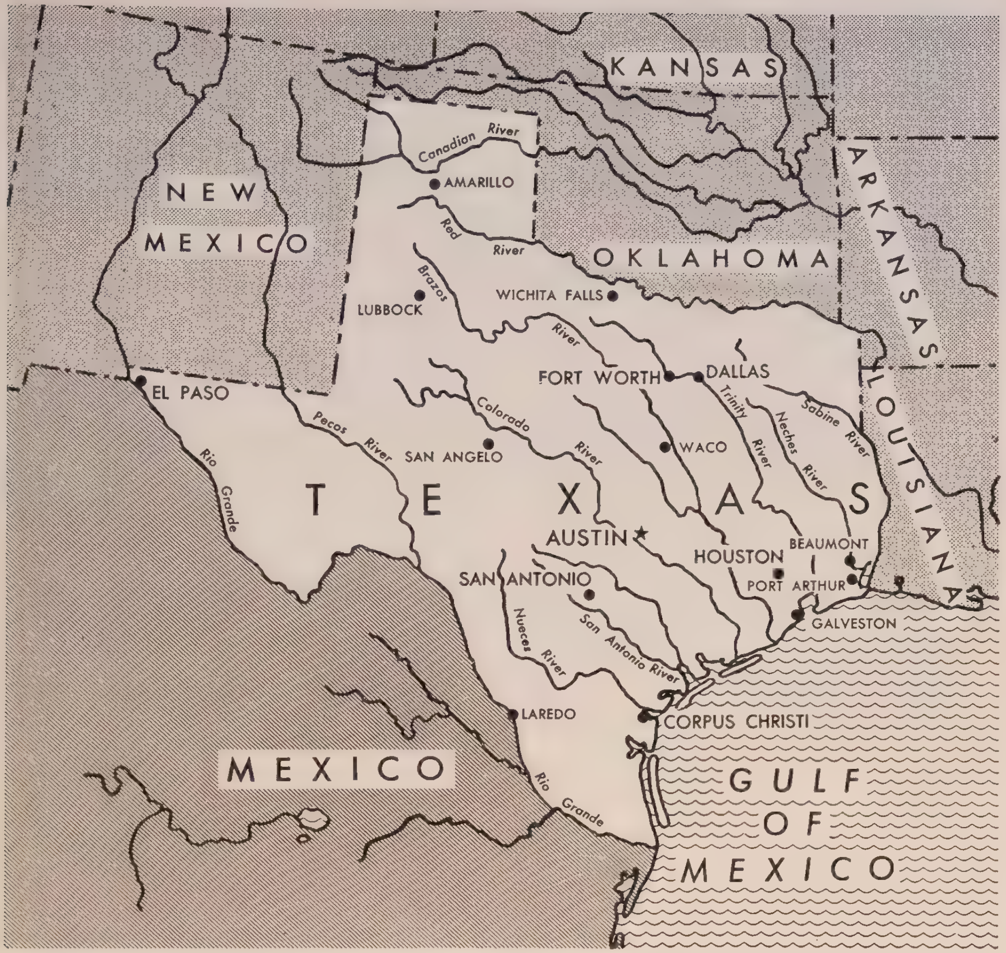
Climate. On account of its vast size and its differences in altitude, Texas has a varied climate. It ranges from moderately temperate in the north and west to subtropical in that part of the Rio Grande Embayment which is only three degrees from the torrid zone. The eastern part of the state is humid, with an annual precipitation of fifty to fifty-five inches, but toward the west the rainfall gradually diminishes until at El Paso it is less than ten inches a year. Snow may fall on the Great High Plain and even farther south, but the greatest discomfort in winter is caused by the cold, sharp wind known as "a norther." The eastern part of the Coastal Plain lies in the wake of the tropical hurricanes which occasionally sweep inland from the Gulf of Mexico in the spring and fall. The greatest destruction was caused in September, 1900, when a tidal wave flooded the lower section of Galveston.

The People and Their Activities

Population. Texas, like the other Southern states, is predominantly Anglo-American. But throughout its history it has been a melting pot not only for Mexicans and Negroes but for some thirty-five European nationalities as well. Outstanding among the Europeans are Germans, Czechs, Italians, Russians, British, Austrians, Swedes, Poles, and Irish. In recent years there has been such an influx of Mexicans that today they number almost three fourths of the foreign-born population. At harvest time the floating population is greatly increased by Mexicans, some of whom enter the state illegally by swimming the Rio Grande and are therefore called *wetbacks.* The Negroes, who are largely descended from slaves brought in by the early colonists, constitute 14 per cent of the total population. The industrial booms of the twentieth century have changed Texas from a preponderantly rural state to one in which the numbers of town and rural dwellers are about even.

Farming and Ranching. Texas owes its reputation as a leading food producer to the fact that it has under cultivation or grazing more than one tenth of the total farm acreage of the United States. Its agricultural holdings range from small truck gardens in the Rio Grande Embayment to huge ranches on the Great High Plain. In the total value of its farm and ranch products Texas is surpassed only by Iowa and California.

The fertility of the river bottoms and of such sections as the Blacklands has made Texas an important cotton producer ever since a large number of Southern planters were attracted to the newly established Texas Republic during the 1830's. Although a diversified form of agriculture has been introduced, the state continues to raise more than one fourth of the entire cotton crop of the United States. The swampy lowlands of southeastern Texas are the source of nearly one fourth of the nation's annual production of rice, and in some years almost one tenth of the winter-wheat crop is raised on the Great High Plain of Texas. The state has been further transformed into a granary through its large-scale production of grain sorghums, oats, barley, rye, and corn. With much of its crop of peanuts, pecans, sweet potatoes, and tung nuts, Texas has carried on experiments in chemurgy, that branch of applied chemistry through which industrial items are developed from agricultural products. Texas-grown fruits, raised mostly with the aid of irrigation in the Lower Rio Grande Valley, include citrus fruits, melons, figs, apples, and strawberries. Many garden vegetables are



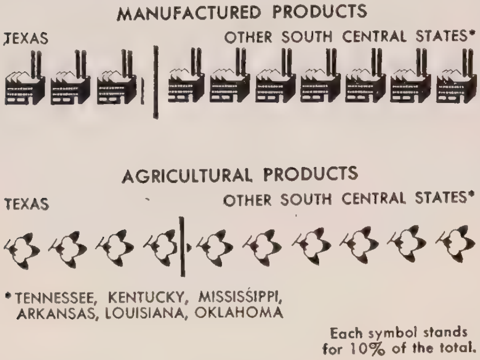
shipped to Northern markets during the winter months.

Since it possesses such extensive grazing lands, Texas is an outstanding livestock producer. It leads all the states in the number of beef and dairy cattle raised; the average marketing of cattle and calves amounts to two million head a year. Instead of the Longhorns that built the fortunes of the first cattle barons, most of the cattle raised today are Shorthorns and Herefords, some of them crossed with the hardy Brahman cattle of India so as to develop a strain resistant to heat and to tick fever. The production of sheep and goats, mainly on the Edwards Plateau and in the southwest, has enabled Texas to contribute more than one fourth of the nation's annual supply of wool and almost nine tenths of the annual supply of mohair. The other livestock raised in the state includes horses, mules, hogs, and such poultry as turkeys and chickens.

Mining. Texas ranks first among the states in the production of petroleum, natural gas, and helium and leads the world in the production of sulfur. The oil fields, widely scattered in most parts of the state, have in some years supplied 44 per cent of the crude petroleum and 40 per cent of the natural gas mined in the United States. As a result of new wells, the annual oil production of Texas has reached an all-time high of over 820,000,000 barrels. Although Texas industries and domestic consumers use much of the 1,800,000 million cubic feet of natural gas produced each year, there is such a surplus that it is piped through high-pressure pipelines to Mexico, Canada, and some nineteen states in the Middle West and East. The Federal Government controls the recovering and processing of helium in Amarillo, the Panhandle's chief city. Most of the sulfur is obtained from cap rocks overlying salt domes in the Coastal Plain.

Texas also produces bituminous coal, lignite, and cannel coal. The western ranges are the source of such metallic ores as silver, gold, lead, copper, and cinnabar (the ore of mercury). The Burnet-Llano Area in the central part is noted for its quarries of granite, limestone, and marble. An electrolytic process permits considerable magnesium to be recovered from the waters of the Gulf of Mexico. The most valuable of the state's miscellaneous minerals are asphalt, fuller's earth, salt, iron ore, gypsum, potash, clay, sand, and gravel.

Manufacturing. The advantages afforded by its wealth of raw materials and supply of cheap fuel have enabled Texas to lead all the Southern states in the value of its manufactured products. It ranks high in the refining of petroleum, and from its natural gas is obtained much of the country's supply of natural gasoline, butane, and carbon black. It is also a leader in meat packing, flour milling, the canning of fruits and vegetables, and the production of butter, cheese, and other dairy products. Considerable newsprint and glazed magazine paper are made from its shortleaf and loblolly pines. Cedar, red oak, and other timber obtained from the Post Oak Belt are made into furniture, crossties, telephone poles, shingles, house piles, and fence posts. Since the state raises such a large cotton crop, it has a number of plants processing cottonseed oil for cooking purposes and cottonseed cake and meal for livestock feed. Limestone is used in the manufacture of cement, and gypsum in the production of plaster and wallboard. The miscellaneous manufactures range from cotton goods, synthetic rubber, plastics, soap, garments, and leather goods to steel, oil-field machinery, pottery, glassware, bricks, tiles, and such chemicals as chlorine and sulfuric acid.



THE VALUE OF TEXAS' PRODUCTS, both agricultural and manufactured, is far greater than that of any other South Central state.

Transportation. Water transportation is assuming increasing importance through the construction of the Gulf Intracoastal Waterway and the Houston Ship Channel and the improvement of various harbors. The leading deep-water ports are Houston, Beaumont, Port Arthur, Texas City, Port Aransas, Corpus Christi, Galveston, and Freeport. Texas ranks next to New York in the volume of cargo shipped annually.

Texas is also a leader in rail and highway transportation. Since the first local railroad was built in 1852 and since the first transcontinental line entered the state in 1881, Texas has been covered with such a network that today it leads all the states, with more than 15,600 miles of railroad trackage. It also has more than 200,000 miles of public roads, of which some 29,300 miles belong to the improved state-highway system. Some of the highways are the outgrowth of mid-nineteenth century stagecoach routes, like the Southern (or Butterfield) Overland Mail and the San Antonio-San Diego route, which army engineers, with the aid of camels, laid across the Southwestern desert in 1857.

Because of the important role which it has played in commercial aviation, Texas today has more airports than any other state. The more important of these airports, at Houston, Dallas, Brownsville, and El Paso, are served by major national airlines and are important stops for planes flying between points in the United States and Latin America. The state also possesses a large number of airports belonging to the armed forces, and because of favorable climatic conditions the United States Air Force has more training fields in Texas than in any other state.

Government and Education

Government. In accordance with the constitution adopted in 1876, the lawmaking powers in Texas are entrusted to a two-chamber legislature which meets in January of odd-numbered years in Austin, the capital. It consists of thirty-one senators elected for four-year terms and 150 representatives from the 254 counties serving for two years. The executive authority is held by the governor and lieutenant governor, who serve for two years. Other elected officers include the attorney general, state treasurer, comptroller, commissioner of agriculture, commissioner of the general land office, and three railroad commissioners. The secretary of state, however, is appointed by the governor. The judiciary is headed by a supreme court, whose chief justice and eight associate justices are elected for six-year terms.

Education. The public-school system of Texas is supervised by the state board of education and is largely supported through a permanent school fund created through investments from the sale of public lands. The largest and wealthiest of the institutions of higher learning is the University of Texas in Austin. Allied to it are Texas Western College (specializing in mining and metallurgy) in El Paso, medical schools at Galveston and Dallas, and a dental school and research institutes at Houston. Among other state-supported schools are the Agricultural and Mechanical College of Texas at College Station, the Texas Technological College in Lubbock, Texas Agricultural and Mechanical College for Negroes in Prairie View, and Texas State University for Negroes in Houston. Outstanding private institutions are Baylor University in Waco, Texas Christian University in Fort Worth, and Southern Methodist University in Dallas.

History

Early Days. The period of Spanish discovery and exploration in Texas extended from 1519, when Alonzo Alvarez de Pineda sailed along the coast of the Gulf of Mexico, until 1684; the next year Spain's claim to the region was for the first time challenged by France. Álvar Núñez Cabeza de Vaca, shipwrecked on the Galveston coast in 1528, crossed Texas on his way to the Pacific, and in 1541 Coronado crossed the Panhandle in search of the fabulously rich land of El Dorado. Numerous other explorers followed. In 1682, Spaniards driven from New Mexico by the Pueblo revolt of 1680 made the first permanent white settlement near a mission at Ysleta, below El Paso. In 1685 La Salle founded a fort at Matagorda Bay, thus establishing the French claim to the region as part of Louisiana. The Spaniards were spurred to further exploration and colonization, and in 1691 made Texas a province of New Spain.

The Texas Revolution. After Mexico proclaimed its independence from Spain in 1821, Texas was first a province of the Mexican Empire and then, combined with Coahuila, a state of the Republic of Mexico. During the period of colonization, however, the Mexican Congress passed so many oppressive laws that in 1835 and 1836 the Americans who had settled in San Felipe de Austin, Washington-on-the-Brazos, and other communities revolted and set up their own republic. A Mexican army sent to disarm the Texans laid siege to the Alamo, killing the garrison of 187 heroic Texans on March 6, 1836; in the Battle of San Jacinto, however, General Houston scored such a victory over the Mexicans on April 21, 1836, that Texas independence was assured.

Independence and Statehood. Texas had its own constitutional government, under four Presidents and a Congress, until it sought and gained admission to the United States in December, 1845, as the twenty-eighth state. There immediately arose a dispute over the southern boundary, and war broke out between Mexico and the United States in 1846. Texas had, in 1836, claimed territory west of the Rio Grande now belonging mostly to Colorado and New Mexico. In 1850 the Federal Government satisfied the claim by paying Texas ten million dollars, with which it settled debts incurred while it was a republic.

Although Texas prospered as a member of the Federal Union, the strength of the slave-owning planter class caused it to join the Confederacy in February, 1861. It was the scene of the last land battle of the War between the States — the skirmish at Palmito Ranch, near the mouth of the Rio Grande, on May 13, 1865. The state was readmitted to the Union in 1870, but home rule was not completely re-established until 1874 because of the general lawlessness of the Reconstruction era. During this postwar period the Texas Rangers played an important role in suppressing attacks by the Comanche Indians.

Texas began its economic recovery during the late 1860's, when it found a means to satisfy the demands of the Northern states for meat. Longhorn cattle were driven over the Chisholm, Dodge City, and Goodnight trails to railroad centers in Kansas, from which they were shipped to stockyards in Chicago. The introduction of barbed wire in the 1870's ended the days of the open range, and many ranchers retaliated against the incoming homesteaders by waging a fence-cutting war that lasted for more than a decade. The signing of water treaties with Mexico during the early part of the twentieth century permitted land reclamation along the Rio Grande and the advancement of farming in Texas. The first commercial oil development took place near Nacogdoches about 1867. But the discovery of new fields near Beaumont in 1901 was the basis for the state's phenomenal rise as a mining and industrial state since the turn of the century. In 1936-37 the state celebrated the centennial of its independence with an imposing exposition in Dallas.

Interpreters of Texas

Texas has long been noted for the cultural activity which has flourished in the wake of its economic prosperity. Its larger cities, like Houston and Dallas, have supported symphony orchestras, art museums, and the little-theater movement.

The "Father of Texas Literature" was John C. Duval, who in 1885 penned *The Adventures of Bigfoot Wallace, the Texas Ranger and Hunter*. Later, literary fame was achieved by the short-story writers Katherine Anne Porter and O. Henry (William Sydney Porter). The state has provided the locale of novels by George Sessions Perry, Margaret Bell Houston, and other authors. James Frank Dobie has been one of its historians, and Mirabeau Buonaparte Lamar, the second President of the Texan Republic, won fame also as a poet.

Alexander Hogue is one of the landscapists who recorded the state's beauty on canvas.

Elisabet Ney, a noted sculptress, made statues of many Texas heroes. In the field of music, Carl Venth is a noted conductor, and John A. Lomax is famous as a collector of cowboy and cattle-trail songs.

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Amarillo
Austin
Beaumont
Brazos River
Colorado River
Corpus Christi
Dallas
El Paso
Fort Worth
Galveston
Houston
Red River
Rio Grande
San Antonio
Waco

GENERAL

Alamo
Austin, Moses and Stephen Fuller
Comanche
Confederate States of America
Coronado, Francisco Vasquez de
Crockett, David
Houston, Sam
La Salle, René-Robert Cavalier, Sieur de
Mexican War
Porter, William Sydney
San Jacinto, Battle of
Texas Rangers

Books for Reading and Reference

- Campbell, Camilla. *The Bartletts of Box B Ranch.* McGraw. Stories of ranch life told for young people.
- Dobie, J. Frank, Ed. *Texas and Southwestern Lore.* University Press. Compiled for the mature reader.
- *Texas: a Guide to the Lone Star State.* Hastings. (American Guide Series.)

TEXAS RANGERS, a body of state police famous in Texas history for their skill and courage in hunting down border outlaws. The Rangers first appeared about 1826 as a band of twenty to thirty men who volunteered to protect the American settlers in Texas against the Indians; they were officially organized in 1835 at the time of the revolt against Mexico. During the period of Texas independence the Rangers served as a standing army to protect the Mexican border, and they also acted as a police force to maintain law and order. After Texas became a state of the Union in 1845 the force was maintained for protection against Indians and desperados. A regiment of Texas Rangers fought for the Confederacy in the War between the States, and in the turbulent Reconstruction period they won a wide reputation for their horsemanship and their marksmanship. They were first organized as a permanent body in 1874, and they were most famous and useful when the cattle business in the Southwest was at its height. Their responsibility and their numbers waned in the twentieth century, and in 1935 they were merged with the State Highway Patrol. Texas Rangers wear no special uniform and today use modern methods of crime fighting, often going about in a radio-equipped automobile instead of on horseback. See also Texas, *History*.

TEX'TILES. Although the word textile comes from the Latin *texere,* meaning *to weave,* the term now generally includes any fabric — woven, knitted, braided, or felted — used for clothing; for home furnishings such as draperies, carpets, household linens, and upholstery; or for industrial purposes. The first textiles were probably mats made of interlaced grasses or vines, but at some time during the New Stone Age men learned how to turn wool or flax fibers into yarn and to weave the yarns into fabrics. Silk was discovered later, in China, and the earliest use of cotton developed in India. Today three fourths of all articles used in the home are made wholly or in part from textiles. The textile industry is an essential part of the world's trade.

Textile Fibers. Textiles are usually made from fibers that can be spun or twisted into yarn. The short fibers, from a half inch to thirty inches in length, are sometimes called *staple.* The very long fibers, or *filaments,* range from 350 yards upward. A textile fiber must have strength, flexibility, and cohesion, or the ability to cling to other fibers. The main natural fibers (animal, vegetable, and mineral) are wool and hair from sheep, goats, camels, and other animals; silk from the cocoon of the silkworm; cotton, flax, ramie (China grass), hemp, jute, and sisal; asbestos, gold, silver, copper, and aluminum. Man-made fibers may have a vegetable or mineral origin. The earliest of these, first called artificial silk and then rayon, is derived from cellulose. Glass fibers fine enough to be spun have been developed, and latex, the sap of the rubber tree, is made into elastic yarn. Synthetic fibers built up from basic chemical elements have been developed since 1938. The best known of them is nylon; but fibers have been made from many chemical compounds, and chemists are now able to produce textile fibers to order.

Spinning. To make yarn or thread, the long textile filaments are twisted together and wound on spools. The short fibers are first cleaned and then *carded,* or passed between fine wire brushes, so that foreign matter and knots are removed and the fibers straightened. For very smooth yarn, the carded fibers are *combed.* This process removes all short fibers and lays the long fibers parallel. The finest cotton fabrics are made of combed yarns, and smooth, hard-finished worsteds are made of carded and combed wool.

After being carded, the fibers are formed into soft rolls, or *slivers,* ready for spinning. This consists of three processes: *drawing,* or combining several slivers and pulling them out into a strand; *twisting* the strand to make it finer and stronger; and *winding.* These three steps are essentially the same

Ford Times; Du Pont Co.; University of North Carolina; Metropolitan Museum of Art

THE WEAVING OF TEXTILES ON A HAND LOOM is a fascinating handicraft (top left). Nylon and other synthetic fibers have become tremendously important in the highly mechanized textile industry (top right). The simplicity of modern textile design (bottom left) offers a striking contrast to the complexity of medieval tapestry (bottom right).

whether the yarn is spun by hand or by machine. Filaments of silk, rayon, or other synthetics are not spun, like the short fibers, but *thrown.* The throwing machines take the long filaments and wind a number of them together, giving them the desired amount of twist. Even fine silk thread is made up of twelve or more filaments. Some rayons contain many more.

Weaving. This is the process of making a fabric by interlacing two or more sets of yarn at right angles to each other. The lengthwise set is called the *warp;* the crosswise is the *woof, weft,* or *filling.* An almost infinite number of fabrics can be developed by varying the kinds of yarn used in the warp and the filling, the pattern of the weave, and the finish given to the goods after it has been woven.

Knitting. As a method of making fabric from yarn, knitting was probably invented much later than weaving. It consists of crosswise rows, or *courses,* of interlacing loops made by a continuous thread, and of vertical rows of loops, or *wales.*

Felting is a process for making a heavy fabric from raw fibers without spinning or weaving. Wool fibers, certain animal hairs, and some synthetics have the ability to shrink and mat together under steam and pressure. The fabrics produced by this method are usually thick and heavy. Fine felts used in hats are made of fur.

Textile Finishing. Textiles come from the loom as *greige* goods (or gray goods), stiff with *sizing,* a heavy starch used to protect the warp. Some are dingy and uneven. The fiber content of the fabric and the use to which it will be put determine the kind and number of finishes to be applied. Almost all textiles must be washed, pressed, and straightened, or *calendered.*

White cottons and linens are bleached. Hard-surfaced, smooth cottons and wools are singed or gassed, to remove any short fiber ends from the face of the material. Silks may be weighted by the addition of metallic salts, and cottons and rayons may be given additional stiffness by being dipped in a solution containing starch, resins, or other filling. Waterproof fabrics are coated with synthetic resin or some other similar substance. *Mercerizing* adds luster and gloss to cottons, and *beetling,* or hammering, makes linens more lustrous. *Sanforizing* is a process for shrinking cottons and linens so that they will not lose more than 1 per cent in length or width when they are laundered. Textiles may be made *crease-resistant* by impregnating the fibers with a synthetic resin. *Napping* is a process of brushing up the fiber ends on the surface of a fabric until a fuzzy nap covers the weave. Wool, spun rayon, and cotton may be napped, because the fibers are short and loosely twisted.

Dyeing. Color may be added at almost any stage of textile manufacture. Fibers may be dyed before they are spun (*stock dyeing*); yarn may be dyed in the skein or on tightly wound spools (*yarn dyeing*); or the completed fabric may be dyed in the piece or printed. Stock-dyed fibers are generally spun into rather heavy yarns designed for use in solid-color, dark fabrics. For heather-mixtured yarns, fibers of various colors are spun together. Yarns dyed in the skein or on spools are used for many plain-color fabrics and for plaids, stripes, checks, and iridescent materials. Piece dyeing, which is cheaper than stock or yarn dyeing, is used for many light, solid-color fabrics and for almost all thin fabrics in dark colors.

Many dyeing processes have been developed to suit the properties of the different types of fibers. The simplest form of dyeing is to force boiling dye through the fiber, yarn, or cloth until the color is absorbed. Some fibers will not take a dye unless a mordant is added to fix the color. An effective mordant is a go-between, acting upon the dye and the fibers in such a way that the color is set. Some fibers will take only special chemical dyes.

Textile Printing. The dyes used in textile printing are the same as those used in stock, yarn, or piece dyeing, and the same problems arise because of the varying ability of different fibers to take dye. In printing, however, the dye is often spread on the fabric in paste form, so that the colors will not run beyond the outlines of the pattern. Colors are applied by three principal processes: direct, resist, and discharge printing.

The oldest form of *direct* printing, in which the pattern is printed directly on the cloth, is *block* printing. In this technique the pattern for each color is drawn on a flat block of wood and the background is then cut away. Each block is dipped into the paste dye and pressed upon the cloth. As many as thirty colors may be used. This process is slow and therefore expensive, but some fine silks, cottons, rayons, and linens are printed in this way.

Modern machine printing is largely done by copper cylinders on which the pattern is engraved. The machine resembles a printing press used for printing paper. As the cloth is passed over a revolving drum, it comes into contact with the dye-carrying cylinders. This roller printing is the fastest method of textile printing, and consequently the cheapest. *Stencil* and *screen* printing are other variations of direct printing. In these, parts of the fabric are protected by a stencil or a screen, and the dye is applied by a brush or a spray.

In *resist* printing, a dye-resisting paste is printed on the fabric and the cloth is then piece-dyed. When the paste is removed, the pattern appears, generally as white against a colored background. *Batik* and *tie-and-dye* are forms of resist dyeing.

Discharge printing is a development of modern chemical bleaching. It consists in printing the pattern with a bleaching paste on a dyed fabric, so that the color is removed or made much lighter in shade.

Textile Judging. The customer who buys garments, household textiles, or yard goods must depend to a large extent upon the information supplied by the manufacturer or by the retail store that sells the merchandise. In judging a textile it is particularly important to know what the fiber content is, how the material is woven or knit, what finishes have been applied, and how the fabric has been dyed. Some of this information may be obtained from the appearance and feel of the material. Combed cotton is finer and smoother than carded cotton; worsteds are generally hard-surfaced; woolens are soft and somewhat fuzzy.

Labeling. Increasingly in the United States, laws are requiring proper labeling of certain textile goods. Any product labeled wool must show the percentage of new, reused, or reprocessed wool fibers in the fabric. Any fabric containing rayon must be labeled, and the weighting of silks is regulated. Some trade organizations within the textile industry have set up standards for correct labeling as a protection for both consumer and producer. More and more textiles are being sold with tags that give the fiber content of the goods, its degree of colorfastness, and the maximum shrinkage.

Colorfastness as defined by the Federal Trade Commission is "the property of a textile or dye used thereon to resist fading, bleeding, crocking, or change of color." No dye is absolutely permanent to sunlight, washing, dry cleaning, and perspiration. Many are fast to washing but cannot stand direct sunlight. *Bleeding* is the spread of color in wet fabrics; *crocking* refers to loss of color from rubbing. Some dyes may change color when the fabric is ironed. Labeling is the consumer's only source of information about colorfastness. When instructions for laundering or cleaning are followed exactly, the customer should find that the textiles wear well and keep their attractiveness of color and shape. Intelligent buying and insistence upon guarantees and correct labels will help both the consumer and the manufacturer.

History. The making of textiles was certainly one of mankind's earliest occupations. Cloth was woven in the New Stone Age, before metal was worked. Flax seems to have been the first fiber used in Europe and the Near East, for fragments of prehistoric linen have been found in many sites, and mummies from Egyptian tombs were usually wrapped in linen cloth. The Egyptians made extraordinarily fine and sheer linen of a quality that has never been surpassed. Wool was spun and woven during the Bronze Age in Europe, and cotton, which probably originated in the Indus Valley, was developed in India before 3000 B.C. Silkmaking was for centuries a jealously guarded secret in China, but silks were used in international trade before the Christian Era. The soldiers of Alexander the Great brought back stories about cotton and silk fabrics from the Orient.

The Persians learned to weave silk in beautiful, decorative patterns, and their knowledge was passed along to the weavers of Damascus and Byzantium. Before the beginning of the Renaissance, Italy became a great textile center, and the brocaded velvets, silks, and fine wools produced in the cities of northern Italy were famous throughout Europe. The French kings brought weavers from Italy to France and established the silk industry at Lyons, where it still flourishes. For generations, wool weaving was centered in Flanders, and the English exported raw wool to be woven by expert Flemish workmen. Persecution of the Protestants in the Catholic countries of Europe drove many Huguenot weavers to seek refuge in England, and by the seventeenth and eighteenth centuries English worsteds and broadcloths had become famous.

While the professional textile workers, highly trained and well organized into powerful guilds, produced most of the elaborate materials used by the aristocracy, cloth for ordinary home use was frequently woven by the women of a household. In ancient Greece, every woman learned to spin and to weave, and the custom of making linen and wool fabrics in the home persisted long after the Industrial Revolution.

Until the eighteenth century little change took place in textile machinery, which consisted of the spinning wheel and the hand loom. In 1733 Kay invented the fly shuttle, which speeded up weaving. Using this, one weaver could keep eight or ten spinners busy providing yarn for his loom. Hargreaves invented the spinning jenny, or spinning engine, about 1764. This was followed in 1768 by Arkwright's roller spinning frame, run by water power, and in 1779 by Crompton's mule, a machine that combined the spinning, twisting, and winding processes. A hand spinner turned out about four skeins a day. With these machines, one man, tending ninety spindles, could produce 180 skeins a day. The power loom, the cotton gin, and machines for printing fabrics helped to mechanize the textile industry still further.

The first cotton and woolen mills in the United States were built between 1776 and 1815, in New England. By 1860 the country was second to Great Britain in the consumption of raw cotton and second to France in number of spindles in operation. Raw silk, imported from China and Japan, became an important part of the textile industry; but silk lost some of its prestige as rayons, nylons, and other synthetics were perfected. In the American textile industry are more than a million workers, who yearly produce goods valued at billions of dollars.

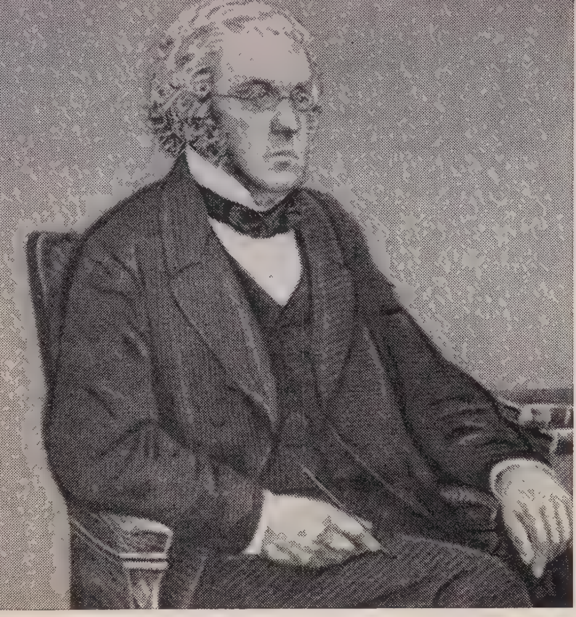
Related Articles. For further information consult the following titles:

TEXTILES AND SOURCES

Alpaca
Asbestos
Cotton (with list)
Flax
Glass
Hair
Hemp
Jute
Linen
Manila Hemp
Nylon
Rayon
Silk
Sisal
Wool and Woolen Manufacture

PROCESSES

Batik
Bleaching
Dyes and Dyeing
Knitting Machine



A HUGE, FRIENDLY MAN, Thackeray labored tirelessly to leave his daughters financially secure, after his wife became mentally ill.

Mercerizing
Spinning
Waterproofing
Weaving

UNCLASSIFIED

Dry Cleaning
Garment Industry
Industrial Revolution
Invention

Books for Reading and Reference

BAITY, ELIZABETH CHESLEY. *Man Is a Weaver.* Viking. The colorful history of weaving.

EBERLE, IRMENGARDE. *Story of Cloth: Spin, Weave, and Wear.* McBride. The story of cloth told for the younger reader.

WINGATE, ISABEL BARNUM. *Textile Fabrics and Their Selection.* Prentice-Hall. An informative book for the mature reader.

THACKERAY, *thak'ur ih,* WILLIAM MAKEPEACE (1811-1863), English novelist and satirist of the Victorian Era, who observed and criticized the artificiality and snobbery of European society. He began his literary career as a humorist, but his novels reveal him as a moralist, well aware of the weakness and wickedness in men. He was born in Calcutta, India, and went to England in 1817. His first interest was in art, and after a short stay at Trinity College, Cambridge, and a brief period spent in studying law, he went to Paris in 1834 to learn painting. Gambling and extravagance soon plunged him into debt, and within a few years he was forced to earn his living by selling articles and caricatures to various periodicals. For ten years he wrote burlesques, parodies, and such social satires as *The Yellowplush Papers* (1838), published in *Fraser's Magazine,* and *The Book of Snobs* (1846-47), written for *Punch.* In 1840, after four years of marriage, he suffered a tragic blow when his wife became hopelessly insane.

Novelist and Lecturer. Thackeray achieved real success with *Vanity Fair* (1847-48), the best known of all his novels. The book has rich humor, vivid descriptive passages, dramatic power, and revealing analyses of human behavior; but dominating all else is the central character, Becky Sharp, one of the strongest personalities in English fiction. The structure of the novel is imperfect, and Thackeray breaks in upon the action, whenever he sees fit, in order to make genial or sarcastic comments. He continued to write for *Punch,* but his fame as a novelist grew steadily with the publication of *Pendennis* (1848-50); *Henry Esmond* (1852), a serious historical romance which many consider his finest work; *The Newcomes* (1853-55), a sequel to *Pendennis;* and *The Virginians* (1857-59), a sequel to *Henry Esmond.* Thackeray thoroughly enjoyed his wealth and fame. He toured Great Britain and the United States, lecturing on *English Humorists* and *The Four Georges* with great success. In 1859 he became editor of the popular *Cornhill Magazine.* His late works include *Lovel the Widower* (1860), *The Adventures of Philip* (1861-62), and the unfinished *Denis Duval* (1864).

Thackeray and Dickens. Dickens and Thackeray were the great novelists of Victorian England, but the works of the two men offer many sharp contrasts. Dickens, a man of humble origin, mixed melodrama and sentimentality with realism in his stories of the poor and the middle class; Thackeray, the gentleman, used reason and restraint in his studies of the rich and the aristocrats. Where Dickens attacked man's institutions, Thackeray attacked man's character. Both men were trained journalists who wrote simply and fluently but as a rule lacked any real sense of form. Both were moralists, in a sense, but Thackeray's sophistication, his apparent cynicism, and his psychological approach resulted in a more complex picture of society and human nature than that given by Dickens. See also DICKENS, CHARLES.

THAILAND, *tī'land,* a kingdom of southeastern Asia long known among English-speaking peoples as SIAM, has had a long history of independence in an area largely occupied by European colonies and protectorates. Its past demonstrates the determination of the Thai leaders that their country should be worthy of its name Muang-Thai, meaning "Land of the Free."

The Land and Its Aspects

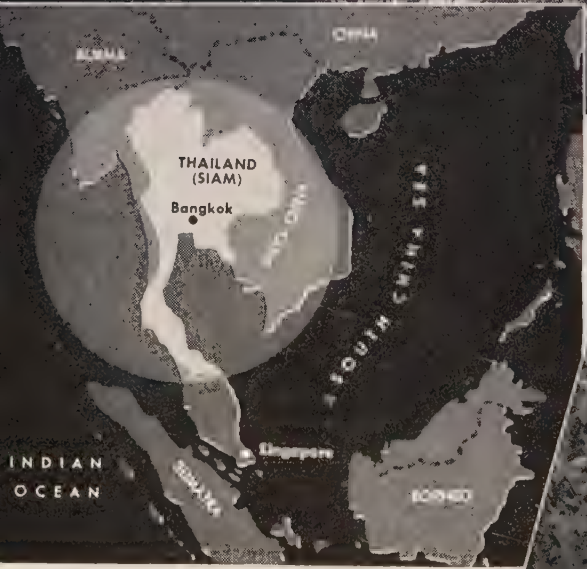
Location and Surface Features. Thailand is a kite-shaped country, occupying an area of about 200,000 square miles. Its upper part, known as Thailand proper, is bounded by Burma on the west and northwest and

Ewing Galloway; Keystone

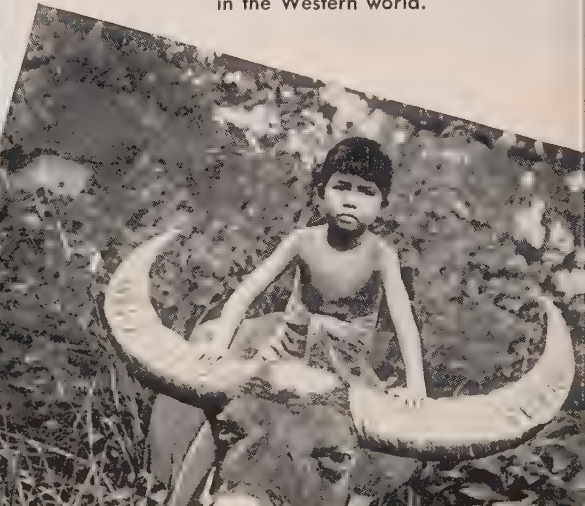
AILAND'S TEMPLES, like the Temple of at Po (Sacred Fig Tree) above, offer a iking contrast to the buildings lining a nal in Bangkok (right) and the homes in a river village (below).

Ewing Galloway

THE GRACEFUL MOVEMENTS of hands and arms in Thailand's temple dances are frequently imitated by performers in the Western world.



PEACEFUL THAILAND occupies a dangerous position in a region torn by political unrest.



A HAPPY PEOPLE, who trust in astrology, gamble on fighting fish, and box with feet as well as fists, the Thai enjoy their simple way of life. At left is a hardware peddler in Bangkok; above is a Lao boy astride his water buffalo.

by the Federation of Indo-China on the northeast, east, and southeast. The lower part, called Peninsular Thailand, is a long, narrow strip, extending from Thailand's narrowest point southward into the Malay Peninsula as far as the Federation of Malaya. The country has two natural boundaries — the Salween River, which separates it from Burma, and the Mekong River, which constitutes a large part of the eastern border.

Natural Regions. The northern part of Thailand is a plateau crossed by the steep ridges of the Dawna Mountains, which attain their greatest elevation in Doi Inthanon (8,468 ft.) and are covered with valuable forests of teakwood, rattan, bamboo, and ebony. The heart of Thailand is the vast, alluvial, central plain which the Chao Phraya, the principal river of Thailand, has been building for countless centuries. Tributaries of this river help form a communication network extending the entire length of Thailand proper. In the southeast a mountain range marks the boundary of the Korat Plateau and northern Cambodia. The Bilauktaung Mountains extend along the border which Thailand shares with Burma in the southwest and, as the Tenasserim Range, reach southward into Peninsular Thailand, the southernmost part of the country. Peninsular Thailand is but ten miles wide at the north, and its widest point does not exceed seventy miles. At the narrowest part of the peninsula is the Isthmus of Kra, long the proposed site for a ship canal linking the Gulf of Thailand on the east with the Andaman Sea on the west.

Climate. Thailand has a tropical climate. The lowlands, especially, are hot and humid during the spring and summer months. The central and southern parts lie in the path both of trade winds from the South China Sea and of monsoon winds from the Bay of Bengal; these cause a rainfall amounting in some sections to more than 100 inches a year. Because of the torrential summer rains many of the thatch-roofed houses bordering the waterways and swampy lowlands have been built on stilts.

The People and Their Activities

The People. Thailand's population of about 17,325,000 are of the Mongoloid stock. More than 80 per cent of these are the Thai, the dominant group. The country has also a large Chinese population, numbering possibly a million. The carefree, pleasure-loving Thai have allowed the Chinese to take over most of the important business enterprises and to handle the retail trade. The principal minority groups are the Malays, the Laos, the Burmese, the Cambodians, and the Annamese.

Buddhism has long been the religion of the majority of the Thai. Bangkok, the capital, is noted throughout the Orient for the distinctive architecture of its Buddhist temples and for the dances which were originally developed as part of the temple rites. In the past there existed a Cult of the White Elephant, which venerated this albino animal because the soul of some great king, or even a future Buddha, was believed to be embodied in it. As a result of the present-day religious tolerance, the Malays are permitted to retain their Moslem religion and many of the Chinese are Confucianists.

Farming. Thailand derives most of its wealth from its agricultural products. The chief crop and principal export is rice, which is raised in vast quantities on the fertile, irrigated central plain. Next in importance are rubber and sugar cane, which are grown on plantations in the south. The chief upland crops are tobacco, cotton, soybeans, peanuts, sesame, and corn. Important fruits and vegetables include bananas, coconuts, peas, beans, and peppers. The bullock, water buffalo, and elephant are used as beasts of burden, and horses, hogs, chickens, and ducks are raised.

Mining. The mountains of Peninsular Thailand are the source of most of the country's minerals. Those mined in commercial quantities include tin, antimony, and tungsten. Gold, silver, copper, coal, iron, lead, zinc, manganese, molybdenum, limestone, and salt exist in varying amounts. Rubies, sapphires, and zircons are among the semiprecious stones.

Manufacturing. Except for the milling of rice and teakwood, manufacturing is of little importance in Thailand. There are, however, a few match and wicker-furniture factories; brick, tile, and cement works; sugar refineries; potteries; and cotton, silk, and paper mills. Among the age-old handicrafts are the production of lacquerware and the manufacture of *niello* silverware, or silverware decorated with a black alloy.

Transportation. From time immemorial the waterways have constituted the chief means of transportation in Thailand. Lumber is floated down the rivers to sawmills, and the floating truck-garden market is a familiar sight on the canals of Bangkok. Since the railroad was introduced in the 1890's, however, the government has laid more than 2,000 miles of track, connecting the capital with various parts of the country. The development of motor transportation has been speeded by the construction of about 4,000 miles of paved roads. Bangkok, located about twenty miles from the sea on the Chao Phraya, is the country's leading seaport. The city is served by some fourteen international airlines, making it the aerial gateway to the Far East.

Government and Education

Government. Thailand is a limited monarchy, operating under a constitution adopted in 1949. This constitution provided for a two-chamber Parliament, consisting of a hundred senators appointed by the king and an equal number of representatives elected by universal suffrage. The executive power is exercised by the state council, consisting of fourteen to twenty-four ministers. The president of the council is the premier. The kingdom is divided into seventy-one provinces administered by commissioners responsible to the minister of the interior.

Education. Thailand has had a system of free and compulsory elementary education for both boys and girls since 1921. The government has also established a number of secondary schools in the larger cities. Chulalongkorn University and the University of Moral and Political Sciences are in Bangkok. The more important private schools are maintained by American, British, and French missionaries, and the Buddhist temples exercise an important influence through their *wat* (religious) schools.

History

In the thirteenth century Thai invaders, whom Kublai Khan had driven from China's Yangtze Valley, overran what is now Thailand and forced out the native Negritos. A century later they set up their own kingdom with Ayuthia (modern Ayudhya) as the capital. Cambodia came under their control, and for hundreds of years they engaged in territorial conflict with Burma. The Burmese destroyed Ayuthia in 1767, and in 1782 Rama I established a new capital at Bangkok and founded the Chakri dynasty, which has since ruled Thailand.

Portuguese traders were allowed to establish posts in Thailand in the early sixteenth century, and Dutch, British, and French traders followed in the seventeenth and eighteenth centuries. A French attempt to impose Christianity on the natives led to a popular revolt against Western influence in 1688. It was not until the early nineteenth century that a commercial treaty was signed with Great Britain; this and subsequent treaties with the United States, France, and the Central European powers gave these foreigners the right to live in Thailand under their own laws.

Thailand began to feel the effects of European colonial expansion in the latter part of the nineteenth century, when it was forced by France to renounce its claims to Cambodia and to give up territory east of the Mekong River. Great Britain surrendered its exterritorial rights in Thailand in 1909, in exchange for parts of Malaya which became the four Unfederated Malay States. In return for Thailand's participation in World War I, the other Allies agreed to end their exterritorial privileges.

During the reign of Rama V (Chulalongkorn), lasting from 1868 to 1910, Thailand's system of debt slavery was abolished, law courts were established, the financial system was reformed, and modern methods of transportation, defense, and communication were introduced. In 1920 the kingdom became an original member of the League of Nations, and in 1947 it was admitted to the United Nations. The absolute monarchy came to an end in 1932, when Rama VII (Prajadhipok) met the demands of the People's party by establishing a limited, constitutional monarchy.

The Japanese invaded Thailand in December, 1941, and set up a puppet government. They allowed the Thai to annex portions of Burma and Malaya and to retain the border areas of French Indo-China seized by the Thai on the downfall of France in 1940. After Japan's defeat, these lands were restored to Great Britain and France. King Rama IX (Phumiphon Adundet) succeeded his brother, Ananda Mahidol, in 1946 and ruled under a regency while he was attending school in Switzerland; he was crowned in Bangkok in 1950. See also BANGKOK; EXTERRITORIALITY.

THALES, *tha'leez,* a Greek philosopher who lived at Miletus in Asia Minor, was one of the Seven Sages of ancient Greece. He was born during the latter part of the seventh century B.C. and probably died in 546 B.C. Thales was one of the first thinkers to look for scientific instead of mythological explanations of natural phenomena. He predicted the total eclipse of the sun that took place in 585 B.C., and he knew some of the principles of plane geometry. He tried to find a single element in all nature and decided that water in its various forms must be the basic substance. Anaximander and Anaximenes were probably his pupils.

THALIA, *thuh li'uh.* See GRACES; MUSES.

THAL'LIUM, a soft, heavy metallic element resembling lead, is bluish white and, like lead, makes a mark on paper. Discovered in 1861 by Sir William Crookes, it is now produced chiefly from the flue dust from zinc smelters. Thallium compounds are poisonous. Thallous sulfate is used as an insecticide and for destroying gophers, rats, and other small animal pests. Thallium bromiodide crystals, which are sensitive to infrared rays, are used in devices for signaling in the dark. Lead alloyed with 20 to 65 per cent thallium is highly resistant to corrosion and is plated on metal parts

Art Institute of Chicago

DORIS LEE'S "THANKSGIVING" captures the hustle and bustle, the friendly co-operation, and the lively anticipation which characterize America's traditional autumn festival.

for chemical machinery. A liquid alloy of mercury and thallium, used in thermometers for measuring low temperatures, has a lower freezing point than pure mercury. Thallium is malleable, melts at 303.5°C., has a specific gravity of 11.85, and is a poor conductor of electricity. The symbol is Tl, the atomic weight 204.39, and the atomic number 81. The metal tarnishes readily when exposed to air.

THAMES, *temz*, **RIVER**, the most important river of Great Britain. It rises in the Cotswold Hills of Gloucestershire, England, not far from the Severn estuary, and flows in a generally eastward direction through beautiful country, passing Oxford, Reading, Windsor, and other historic towns before entering London. East of London Bridge the tidal reaches of the river begin to merge into a large estuary, which opens into the North Sea. The Thames is about 209 miles long, and it is navigable for large vessels for about sixty miles up to the extensive London docks. The upper river carries barge traffic and small boats for most of its length, and it is part of a large network of canals and streams covering the Midlands. A series of locks control the flow of the river, thus preventing serious floods in London and protecting the city water supply, which comes mainly from the Thames. At London Bridge the river is about 750 feet wide. At Oxford, where it is sometimes called the Isis (from its Latin name, *Tamesis*), it is only 150 feet in width. A number of traditional boat races and regattas are held on the Thames.

THANKSGIVING DAY, the fourth Thursday in November, is a legal holiday on which the people of the United States give thanks for their blessings. The earliest harvest thanksgiving in America was celebrated by the Pilgrim Fathers in 1621 as an occasion for feasting and prayer. Eventually the holiday was annually observed in several of the colonies. During the Revolutionary War the Continental Congress proclaimed a Thanksgiving celebration nearly every year. The first Thanksgiving Day proclamations under the Constitution were issued by President Washington in 1789 and 1795, and President Madison issued a proclamation in 1815 at the end of the War of 1812. During the following decades Thanksgiving Day was celebrated in an increasing number of states. In 1863, during the War between the States, President Lincoln proclaimed the fourth Thursday in November as a national holiday; his precedent was followed annually thereafter, though President Roosevelt in 1939 proclaimed the third Thursday in November. Some states refused

United Artists Corp.

IN THE MOTION PICTURE VERSION OF *HENRY V*, the Shakespearean theater was re-created. At the left, a prompter follows the actor's lines; at the right, nobles sit upon the stage.

to accept this change, and two years later Congress established the fourth Thursday as the legal date and made it a national holiday. Canada has a similar holiday which is held on one of the Mondays in October.

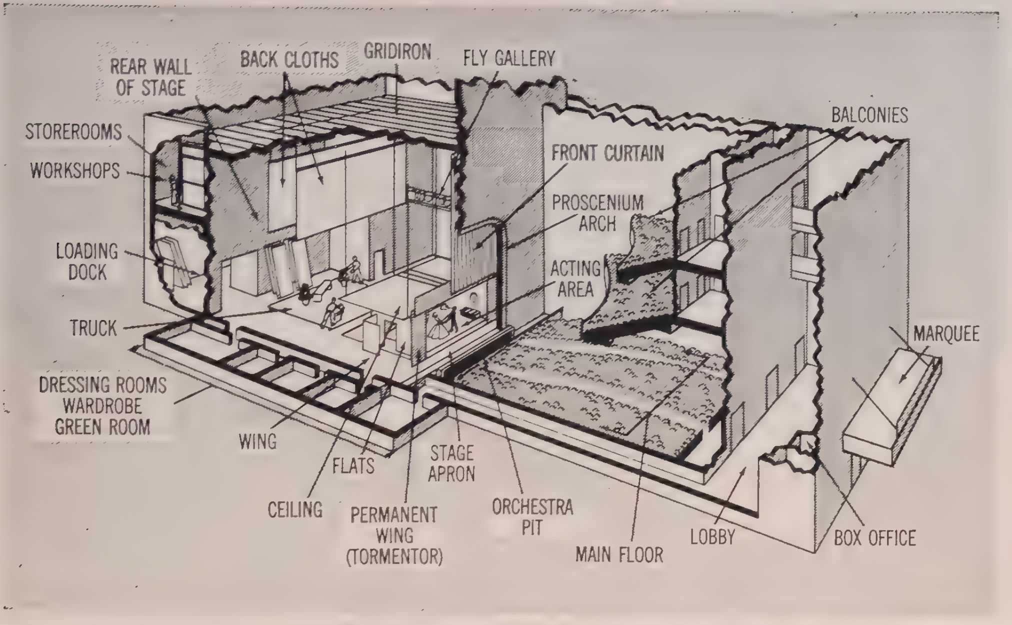
THAYENDANEGEA, *thay en duh neg'ih-uh.* See BRANT, JOSEPH.

THE'ATER, a place where plays are presented before an audience. By extension, the term also covers what happens on the stage. Until the rapid development of motion pictures in the twentieth century, which led to the building of a movie house in almost every town of even moderate size in the United States, Canada, and many South American and European countries, people thought of a theater as a place where a company of actors appeared in a play, a musical comedy, a vaudeville show, or a review. In Europe a special name, such as cinema, is generally used for a motion-picture house, while the word theater retains its old meaning. An opera house may also be called a theater. In the United States a house in which traditional stage plays are performed is sometimes known as a *legitimate* theater.

History and Development

The Greek Theater. The modern theater developed by various steps from the open-air amphitheaters where the ancient Greeks gathered to watch the classic tragedies and comedies. These early theaters consisted of a circular dancing place called the *orchestra,* almost surrounded by tiers of stone seats. The orchestra was usually at the base of a hill, and the rising tiers of seats were built into the hillside. On the open side of the orchestra was a simple platform, or stage. The chorus danced and chanted in the orchestra, taking the part of crowds in some scenes, and commenting on the action of the play. The leader of the chorus usually took a speaking role. There were seldom more than three actors. The stage platform was given a rear wall, with entrances by which the actors came on the stage, and columns across the front suggested that the scene represented a palace or a temple. There was no real scenery, but there was evidently some mechanical contrivance by which an actor playing the part of a god could be lowered to the stage from above, as though he came from the sky.

Because the early theaters were very large, the actors wore conventional costumes and masks, so that the audience could tell at once which character each actor represented. Mouthpieces like small megaphones were built into the masks in order to make the voices carry to the topmost tiers of the theater. The actors in a tragedy wore buskins, shoes with a high platform, in order to look taller than ordinary human beings. Women did not take part in the performances; young men played the female roles. The Greek plays were generally given in groups of three, and performances lasted from sunrise to sunset. Of the many Greek



THE THEATER, TO THE THEATER-GOER, consists of the box office, the lobby, the main floor and balconies, the orchestra pit, and the stage. Entirely hidden from his view is the bustling backstage area, in which dozens of craftsmen and technicians assist the performers in creating the theatrical world of make-believe.

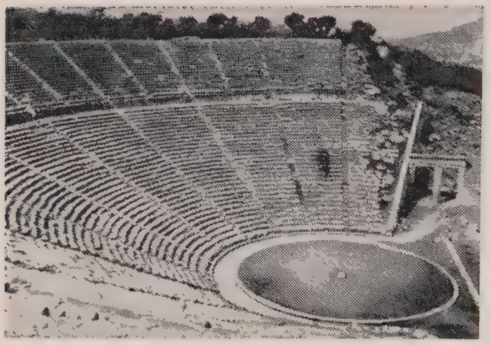
theaters the foremost in classical times was the theater of Dionysus at Athens.

The Theater in Rome. The Romans built similar theaters of stone or masonry. The seats formed a half circle, and the raised stage, or scene, stretched across the open side. Five entrances — three at the back and two at the sides of the stage — became traditional. Roman theaters were set on level ground; and since the Roman playwrights did not make use of the Greek chorus, the orchestra was given over to seats for important personages. The best seats on the main floor of a theater are still called orchestra seats. Some Roman theaters were roofed, and the stage was generally covered so that plays could be presented even in bad weather. Roman plays were not religious ceremonies, as Greek plays were. They were primarily intended as entertainment, and farces were popular. The art of the actors was more interesting to the Romans than the art of the dramatist. Poetic tragedies were read, but they were seldom put on the stage.

The Middle Ages. After the collapse of Roman civilization, the theater in Europe went into eclipse. Dramatic art was kept alive only in the churches, where the sacred stories were often acted in honor of the great religious festivals (see MIRACLE PLAY; MYSTERY). These religious plays were eventually moved from the interior of the church to the open space in front of the main entrance, and then to the street. The workers' guilds took over the responsibility for the performances, and, later, wandering players began to entertain the people with stock farces and comedies that had no religious meaning at all. The stage was usually a rough platform with a curtain at the back.

The Renaissance was a rebirth of the drama as well as of the other arts, but until the sixteenth century the organized companies of actors had no regular playhouses. They put on their plays in innyards or in the great halls or gardens of the wealthy aristocrats. In the early Italian theaters, which followed the Roman tradition, the seats for the spectators were arranged in a semicircle, and the classical stage setting with five entrances was retained. The overhanging roof of the Roman stage developed into the proscenium arch, which acts as a kind of frame for the picture created on the stage of today.

The Elizabethan Theater. In Elizabethan England, when business was poor because of the plague in London or when royal favor was withdrawn, the companies of players traveled around the country, usually giving their performances in the open courtyards of country inns. The audience sat in the galleries surrounding the yard or stood in the open space in front of the stage. Many of the London theaters built in Shakespeare's time were patterned after



THE RUINED THEATER at Epidaurus once provided a site for the presentation of the great Greek dramas of ancient times.

the innyard. The famous Globe Theater, in which many of Shakespeare's plays were first given, was a wooden structure, built around an open court. The spectators, who surrounded the stage on three sides, sat in the covered balconies or stood in the open pit. The stage was a simple platform with a curtained recess at the back, below a small balcony. The plays were given in the daytime, by natural light. There was no scenery, and only a few movable properties were used.

These open-air theaters were popular, but many companies also presented plays in indoor theaters of the Italian type. The stone Blackfriars Theater, which was also owned by Shakespeare's company, was rectangular in shape. Galleries surrounded the pit; but the stage filled one end of the hall, and all of the spectators, except for a few privileged ones who sat on the stage itself, were in front of the platform where the actors appeared. The curtain across the front of the stage, marking the division between the acting space and the auditorium, did not come into use until the seventeenth century. Movable scenery instead of a permanent formal backdrop was used about 1630, and toward the end of the century women were allowed to join the acting companies and play female roles.

The Theater Today. Modern theaters are often large and elaborate, but they are not essentially different in design from those of the seventeenth century. The auditorium is usually horseshoe in shape, with a floor that slopes toward the stage. The balconies or galleries above the main floor have a still sharper slant, so that each row of onlookers may have an unobstructed view of the stage. In addition to the auditorium the public part of the theater includes a lobby, a box office where tickets are sold, check rooms, and restrooms. The musicians of the theater orchestra occupy a sunken pit between the front seats and the apron of the stage.

Backstage are dressing rooms; the green room, which is a kind of club room for the actors; storage rooms for properties and stage sets; and the complicated switchboard that controls the lighting effects. The spaces on either side of the stage are called the wings. The upper region beyond the view of the audience is the fly gallery, or the flies. Scenery not in use is frequently hung in the flies.

In most states and cities theaters must comply with strict fire laws. Scenery must be fireproof; an asbestos curtain between the stage and the auditorium is required; and there must be enough clearly marked exits, with doors opening outward, so that the hall can be emptied quickly in case of fire or panic.

How Plays Are Produced

Scenery. Until the nineteenth century, scenery was used only to provide an unobtrusive background for the play. There was little effort made to suggest the place where the action of the play occurred. The flat pieces of painted scenery, or *flats,* served to conceal the structure of the stage and to indicate whether the scene was indoors or outdoors. Later, indoor scenes were constructed with walls, a ceiling, and doors for entrances and exits. In the nineteenth century producers tried to make these scenes as real as possible. Scene shifting became a complicated task, and stage designers tried out various methods of changing scenes. One solution of the problem was the stage that revolved.

The modern tendency is in general away from realism. In such plays as Thornton Wilder's *Our Town* the action takes place on a bare stage, and very few properties are used. Many plays, like *Death of a Salesman,* by Arthur Miller, are presented on a single, rather symbolic set. As the action shifts from one part of the stage to another, the lights focus the attention of the audience on the limited space where the action is taking place. A few movable properties are used to suggest a change of scene. Plays may be staged without scenery, against a background of neutral draperies. Platforms of different heights may break the monotony of the flat stage, and lighting can create changes of mood. Some plays, however, need a realistic setting, and it is the play itself which determines the kind of scene to be used.

Properties. Stage properties include everything used on the stage, except the scenery, from the small objects carried by the actors to the large pieces of furniture. The head property man is responsible for having everything in place and at hand for each scene. His men move the props when the scene is changed, while the stage crew handles the scenery.

Make-up. By the use of grease paint, cosmetics, spirit gum, putty, and powder, an expert make-up man can give an actor a totally new appearance. A young man can be made to look old; a handsome one, ugly. But make-up is necessary even for the actor who wants to look like his natural self, since the artificial lights of the stage turn even vivid natural coloring to drab pallor.

Repertory. In Europe, organized companies of actors have been the rule for centuries. The Comédie Française in Paris is a national institution dating from the reign of Louis XIV. Such a company has a permanent home and a standard repertory. The Moscow Art Theater, founded in 1898, was, under the direction of Stanislavsky, one of the best-trained groups of the early twentieth century. These Russian actors, who brought realism to perfection, had great influence on the contemporary theater.

In the United States there are many small civic theaters with amateur or semiprofessional companies that give a series of plays each season, and many colleges and universities are known for their student acting companies. Putting on a play is a popular activity even in the grade schools. Repertory companies organized by popular actors or actresses were common in the nineteenth century, and professional stock companies still find the slack summer season profitable in summer resorts. The professional production play, however, is generally acted by a specially chosen cast.

Professional Theater. The production of a new play or musical show is usually a costly venture and, since the public may immediately reject the offering, a very risky one. For these reasons, among others, new shows are usually launched only in the largest cities, where talent, money, and crowds of theatergoers are readily available. London and Paris are centers of theatrical activity in Europe. The theatrical capital of the United States is a small section of New York in the vicinity of Times Square; as Hollywood is the center of the motion-picture industry, Broadway is the home of the legitimate theater. Most of the well-known actors, producers, directors, stage architects, costume designers, and other artists and technicians necessary to the production of a play are in New York, and the final test of success for any play is its reception by New York audiences.

THE THEATER IN JAVA, as in other parts of the Far East, presents traditional dramas which have been enjoyed by generations of spectators.

When the producer (who may be an individual, a corporation, or a partnership) decides that an author's play has a reasonable chance of success and that the financial risk is not too great, he arranges the necessary financing. An investor who puts up money for a show is called, in theater slang, an *angel.* The producer then engages a director and a cast. The director is responsible for the staging of the play. He directs the actors and helps them to project the characters that they are playing. He plans the movement of the actors on the stage so that even the smallest gesture will contribute to the total effect he is trying to create. He is like an orchestra conductor, who blends the sounds of the individual instruments into a harmonious work of art.

The director's executive officer is the stage manager, who handles all details. After the run of the play has begun, the director's job is finished, and the stage manager takes over as head of the company. Under him are the crews of stage hands, electricians, property men, and other professional workers. The producer and the director usually choose a stage designer to execute the settings and lighting for the play. The costume designer works out the costumes to be worn by the players; and if there is dancing in the play, a choreographer is called in to create the dances.

When the play has gone through several weeks of rehearsals and is ready for public presentation, it is usually given a tryout in some town near New York. The reaction of an audience to the play may result in some changes in the script or in the stage business. The performance is polished and tightened up before the New York opening, on which success or failure depends. Only a few of the plays produced each year are hits; a few more run long enough to repay the original investment; the rest are failures.

Hit shows may run for months in New York. Some go on for several years. If a play seems set for an indefinite run, the producer often decides to send a road company on tour while the original cast is still performing in New York. The fabulous musical comedy, *Oklahoma!* by Rodgers and Hammerstein, ran there for six years, and

LONG THE CAPITAL of ancient Egypt, Thebes, far up the Nile, lost its position of supremacy to cities near the river's mouth.

several road companies took it from one end of the country to the other, as well as abroad. In some cases the original company makes a tour of the larger cities after the Broadway run is over.

Actors and Acting

Even in the early English theater the acting companies had certain players who took the important roles and became known as stars. The public flocked to see a star in each of his roles, and the art of the actor seemed much greater than the art of the playwright who created the character played. The star system has continued into the present. During the nineteenth century people went to the theater to see the popular stars — not to see and hear the plays in which they appeared. The famous actors toured Europe and America with their own companies or appeared as guest stars with local companies.

The style of acting was usually declamatory. The actors addressed the audience in their long speeches, using highly dramatic gestures. The modern style of controlled, realistic acting, in which the actor never steps out of his role and usually underplays emotional scenes, is gaining in popularity, but some actors and actresses still prefer the more heroic style.

The Oriental Theater

The theater in the East probably had its origin in ritual dancing and music, as did the Western theater. In the Chinese and the Japanese theaters there is much greater use of symbolism than in the West. There is little scenery, the costumes are conventional, and the actors speak and move according to a system of conventions. Even color has a symbolic meaning. Women do not appear on the stage in China, and young men are trained to play female roles.

Related Articles. For further information, consult the following titles:

ACTORS AND ACTRESSES

Barrymore
Bernhardt, Sarah
Booth
Fiske, Minnie Maddern
Garrick, David
Jefferson, Joseph
Modjeska, Helena
Rachel
Siddons, Sarah K.
Sothern, E. H.

GENERAL

Ballet
Dance
Drama
Moving Pictures
Opera
Vaudeville

Books for Reading and Reference

Cheney, Sheldon Warren. *The Theater: Three Thousand Years of Drama, Acting, and Stagecraft.* Longmans. A comprehensive history of the subject.

Denis, Paul. *Your Career in Show Business.* Dutton. Vocational opportunities in the theater.

Dolman, John, Jr. *The Art of Play Production.* Harper. A practical guide to stagecraft.

THEBES, *theebz,* Egypt, in ancient times the chief city of Upper Egypt and for centuries the capital of the kingdom, was situated on the Nile about three hundred miles above modern Cairo. From 2100 to 2000 B.C. and again between 1580 and 1090 B.C., Thebes was the shrine of the god Amon-Re and the capital of the Pharaohs. The rich and powerful kings built great temples here, and they cut elaborate tombs in living rock in the Valley of the Kings nearby. Power gradually shifted to the delta region of Egypt, and before the beginning of the Christian Era, Thebes disappeared as a city. Its site is marked by several villages, such as Luxor and Karnak, and by the impressive ruins of the temple at Karnak, the double row of stone sphinxes leading to the royal tombs, the huge statues called the Colossi of Memnon, and the tombs of the Pharaohs, which have produced untold treasures of gold and jewels, paintings, sculptures, and even household objects thousands of years old. The most remarkable discovery of the archaeologists was the untouched tomb of Tutankhamen, which was opened by British archaeologists in 1923. See also Egypt, *History;* Tutankhamen.

THEBES, Greece, a town in central Greece, about forty miles northwest of Athens, was one of the early citadels dating back to legendary times. Greek mythology contains many stories about Thebes, which was surrounded by a massive wall with seven gates. According to legend, Cadmus founded the city in 1500 B.C., and the tragic Oedipus was one of its kings. In historic times Thebes was the chief city of Boeotia and organized most of the surrounding towns into the Boeotian League. Its great rival was Athens. The Thebans and the Athenians were often at war, but they also joined together at times to fight a common enemy.

THEMISTOCLES AND HIS VICTORIOUS WARRIORS were given a tumultuous welcome upon their return from the historic Battle of Salamis.

Epaminondas was the greatest of the Theban generals. Thebes revolted against Macedonian rule and was destroyed in 336 B.C. by Alexander the Great, who spared only the temples and the home of the poet Pindar. Although Thebes was rebuilt, it never regained its former position among the Greek cities. The present population is about 7,500. See also CADMUS; OEDIPUS; PINDAR.

THEINE, *the'een*. See CAFFEINE.

THEMISTOCLES, *thee mis'toh kleez* (about 525 B.C.–about 460 B.C.), a celebrated Athenian statesman, was one of the Greek leaders in the critical period of the struggle between Greece and Persia. Even before the Athenians beat off the Persian attack at Marathon in 490 B.C., Themistocles had urged them to strengthen the navy (see MARATHON). In 483 B.C., after a rich, new vein in the state silver mines yielded new revenue, Themistocles again advised the Athenians to build many new warships. Xerxes, the Persian king, led a new expedition against Athens in 480 B.C., and Themistocles, general in chief of the Greeks, told the people to abandon their city and take refuge in their ships. The invaders forced the pass of Thermopylae, advanced into Attica, and burned Athens. The Persian fleet supporting the land army moved into the Saronic Gulf, and the combined fleet of the Athenians and Spartans caught them in the straits between the island of Salamis and the mainland. Themistocles persuaded the Spartan admiral commanding the warships to attack the superior Persian forces. According to tradition, Xerxes watched from the shore and saw his great fleet put to rout. Themistocles later became involved in intrigues against Sparta and was exiled from Athens when the pro-Sparta group rose to power. He eventually fled to Asia, where he died.

With Athens in command of the Aegean waters, piracy was put down, commerce flourished, and Athens came into the time of its greatest glory, the golden age of Pericles. See also GREECE, *History*.

THEOCRACY, *thee ok'ruh sih*, literally, "government by God," the name given to a state in which God is regarded as the sole sovereign, and the laws of the realm are considered to be divine commands rather than human ordinances. The priesthood, therefore, become the interpreters of the "divine commands," act as the officers of the Invisible Ruler, and have authority as well in civil matters. The typical example of a theocracy is that established by Moses among the Hebrews. The governments of colonial Massachusetts and Connecticut were at times theocratic in nature. See also GOVERNMENT; TIBET.

THEODORIC, *thee od'oh rik*, or **THEODORIC THE GREAT** (about 454-526), was the founder of the Ostrogothic kingdom in Italy in the years following the fall of Rome (476). By this time the Germanic peoples had overrun the western part of the empire and penetrated into Italy. When he was about seven, Theodoric was sent as a hostage to Constantinople, the capital of the Eastern Empire, where he received a good education before returning to his own people, who were then settled in the northwestern part of the Balkan peninsula. He succeeded his father as king of the Ostrogoths about 474. In 476 a German chief, Odoacer, or Odovacar, deposed the last of the Western emperors and made himself master of Italy. The Emperor Zeno, ruler of the Eastern Empire, invited Theodoric to retake Italy for the empire, and in 488 a large army of Ostrogoths under the command of Theodoric moved into Italy. After nearly five years of fighting Theodoric defeated Odoacer and killed him.

The reign of Theodoric was a long and useful one. He gave Italy a period of peace and prosperity under a generally good administration. Since he considered himself an official of the Roman Empire as well as king of his own people, he did not attempt to change Roman customs and Roman law, and for the most part he did not fail to co-operate with the Roman Church, even though he belonged to the Arian sect. He built several churches and an imperial palace in Ravenna, where his tomb still stands. Theodoric appears in German folklore and legend as Dietrich of Bern.

THEODOSIUS, *thee oh do′shih us,* the name of three Roman emperors.

Theodosius I, called Theodosius the Great (about 346-395), was born in Spain and saw service in Britain with his father, a Roman officer. In 379 the Emperor Gratian named him joint ruler, in control of the Eastern provinces, where he succeeded in establishing a settlement with the invading Goths by making them allies of Rome and inviting them to enter the Roman military service. Theodosius returned to the West in 388 to defeat Maximus, who had overthrown Gratian and ruled in his stead, and, six years later, to crush the rebels who in 392 murdered Valentinian II, the son of Maximus, whom Theodosius had named Western Emperor. In 390, after a rebellion of the Greek city Thessalonica, Theodosius ordered the slaughter of seven thousand of its citizens. St. Ambrose demanded that he do public penance for this crime, and Theodosius, a devout Christian, humbly obeyed. At his death he left the eastern portion of the empire to his son Arcadius and the western portion to his son Honorius.

Theodosius II (401-450) succeeded his father Arcadius as Emperor of the East in 408. During his reign, in which his sister and various officials largely controlled his moves, war was waged with Persia and tribute paid to the threatening Huns under Attila. The *Codex Theodosianus* is a collection of imperial constitutions made in this period.

Theodosius III replaced Anastasius III on the throne of the Eastern Empire as the result of an army uprising in 716. A few months later he was overthrown and replaced by Leo III.

THEOLOGY, *thee ol′oh jih,* is, in the general sense of the term, the study of God. Each of the world's three great monotheistic religions — Christianity, Judaism, and Mohammedanism — has a theology; but in the Western world Christian theology is the one generally referred to. Sometimes the term is broadly used to include every field of study related to Christianity; more specifically, it is applied to the systematic presentation of Christian doctrines and duties. Early Christianity was a simple formula of faith and works: love of God, belief in Christ as God's medium of salvation, charity toward others, righteous living, and doing good deeds. But as the new religion gained converts among the educated classes its faith had to be explained in terms of Greek philosophy; Christian revelation had to be reconciled with Greek reason.

Most theological discussion has centered around the nature of Christ, his relation to God, and the relation of man to God through Christ. Theologians acknowledge St. Augustine (354-430) as the founder of theology, for he expressed in his writings what came to be the theology of the early Christian Church. Another great theologian was St. Thomas Aquinas (1225?-1274), who combined all existing knowledge into a whole and harmonized it with Christian doctrine. Thomist theology, the theology of St. Thomas Aquinas, is still dominant in the Roman Catholic Church. The greatest Protestant theologian was John Calvin (1509-1564). Modern theology has been largely preoccupied with the attempt to reconcile Christian faith with science and philosophy. Divergence from the accepted teachings of Christian theology has from earliest times been treated as heresy.

Related Articles. For further information, consult the following titles:

Aquinas, Saint Thomas
Augustine, Saint
Calvin, John
Christianity
Heresy
Religion

THE′OREM. See Geometry.

THEOSOPHY, *thee os′oh fih,* from two Greek words meaning "God-wisdom" or "God-science," may be defined as knowledge of divine reality. In a restricted meaning the term refers to the teachings of the Theosophical Society, but in a broader sense it includes any system of religious philosophical thought which claims a special insight into the nature of God through some mystical or occult experience or through deep speculative wisdom.

Theosophy is neither religion nor philosophy, but it includes elements of both. In general, it holds that the processes of the Divine nature are manifested in and through the universe. The theosophist believes that in order to understand and control both himself and the universe he must first understand the Divine nature. Theosophy normally combines emotion and reason; it usually begins with a mystical experience or some sudden intuition and then proceeds by reason to show how the Divine Being operates in the world. Religious mysticism has sometimes developed into theosophy.

Theosophical thought has appeared in many lands and in connection with many religions.

Since ancient times it has been prominent in the religious and philosophical thinking of India. In the early Christian centuries theosophy appeared in Neoplatonism, which first used the term, and in Gnosticism. Among the Jews, theosophical thought was evident in the teachings of the cabala. The German mystic Jakob Boehme (1575-1624), who developed a system aimed at reconciling the co-existence of a perfect God and worldly evil, is regarded as the founder of modern theosophy.

The Theosophical Society was organized in New York in 1875 by Helena P. Blavatsky, a Russian, whose book *The Secret Doctrine* is the authority of modern theosophy. The announced objects of the society were: to form a nucleus of the universal brotherhood of humanity; to study ancient and modern religion, science, and philosophy; and to investigate the unexplained laws of nature and the powers latent in man. The center of the new world organization was later transferred to India. After the death of Madame Blavatsky in 1891 many divisions appeared in the movement. The most prominent of the later leaders was Annie Besant, who was president of the original society from 1907 until her death in 1933.

THERAPEUTICS, *thehr uh pyu'tiks,* is that branch of medicine which deals with the treatment of disease. The term is derived from a Greek word meaning *to care for.* Those who specialize in the treatment of disease are called *therapists,* and the methods they use in treating disease are known as *therapy.* For a discussion of the various methods of treatment consult the article on DISEASE.

THERESA, or **TERESA,** *teh re'suh,* SAINT (1515-1582), was born Teresa de Cepeda in Avila, Spain. She was convent-educated and became a Carmelite nun. When she was nearly forty, she experienced a second conversion and saw visions that led her to urge a return to the old, strict rules of the Carmelites. In 1562 she received permission to found a new convent at Avila. She and the other nuns wore rope sandals, slept on straw, and lived on charitable donations. The reform movement was at first opposed by many Carmelites, but Theresa eventually won permission to establish new houses in Castile. Before she died she had founded sixteen convents and fourteen monasteries dedicated to the original Carmelite discipline. She was a very able and charming woman and a gifted writer. Her autobiography, an account of her work of reform, and several volumes of mystic teachings had great influence. Her vigorous reforms helped the Catholic Church in its struggle with Protestantism. She was canonized in 1622 by Pope Gregory XV. October 15 is her feast day.

THER'MAL SPRINGS, or **HOT SPRINGS,** have temperatures higher than that of the air about them. In some cases their waters are boiling, and they may erupt as geysers (see GEYSER). The craters of some hot springs extend through cracks and crevices to a great depth, and the water, rising from deep in the earth, brings to the surface some of the heat from the rocks below. Springs of hot water are common in areas where there has been volcanic activity, for here molten rock may be located relatively near the earth's surface. Most thermal springs contain dissolved minerals and deposit this mineral matter around their edges, often making beautiful formations. America's Yellowstone National Park and an extensive region on New Zealand's North Island are famous for their boiling springs, and hundreds of localities, such as Hot Springs, Ark., Hot Springs, S.D., and Karlsbad, in Czechoslovakia, are known for the medicinal properties of their thermal springs. See also MINERAL WATERS.

THER'MITE, a mixture of powdered aluminum and iron oxide (trade name, "Thermit"), is used for welding metals. When ignited by means of a magnesium fuse, the aluminum takes the oxygen away from the iron oxide, forming aluminum oxide and pure iron. The reaction generates intense heat, and the iron that forms is molten. The heat of the molten iron melts the metal parts to be welded and, on cooling, solidifies with them. Thermite is particularly useful in welding the sides of ships, the ends of rails in paved streets, and parts of heavy machinery that must be welded without being dismantled.

A thermite incendiary bomb, made of a core of thermite and an ignition mixture in a magnesium casing, is used in air attacks. When a bomb strikes the ground, a needle is driven into a percussion cap, causing the ignition mixture to ignite. The mixture ignites the thermite, which, in turn, ignites the magnesium casing. The magnesium then burns with intense heat. A fire set by a thermite bomb may be extinguished by covering it with sand or salt.

THER'MOCOUPLE, a device used for a wide range of temperature measurements, from the low temperature of liquid air to the melting temperatures of some metals. It makes use of the Seebeck effect, one of several phenomena in thermoelectricity that involve transformations between thermal and electrical forms of energy. In a closed circuit containing two junctions of two different metals the Seebeck effect is a flow of current that occurs when the two junctions are at different temperatures. The quantity measured by a thermocouple is not the temperature, but usually the electromotive force (*emf*) that drives the current through the circuit (see Electromotive Force). The amount of emf developed depends upon the temperatures of the two junctions and the metals used.

In determining the temperature of a body, one junction of a thermocouple is placed in contact with the body and the other is kept at constant temperature. A temperature of 0°C. is easily maintained by surrounding the junction with melting ice. The difference between this constant temperature and the temperature of the other junction, and hence of the body, is then calculated from the observed emf and the constants that have been determined previously for the metals. A thermocouple of copper and constantan (an alloy of copper and nickel) may be used over the range −200° to +300°C., and one of platinum and an alloy of platinum with iridium or rhodium may be used up to 1500°C. or higher.

A *thermopile,* which is essentially several thermocouples in series, is a device much more sensitive than a single thermocouple. Two metals A and B joined in a sequence A-B-A-B-A-B make a thermopile of three thermocouples when alternate junctions are grouped together so that one set of three junctions can act like the cold junction of a thermocouple and the other set like the hot junction. The thermopiles used in such very delicate measurements as that of the heat produced by a nerve, or the amount of radiant energy received from distant sources like planets and stars, are often made of very fine wires of bismuth and silver.

The total emf developed in *thermels* (a term for all temperature-measuring devices making use of the Seebeck effect) depends also upon the Peltier and Thomson effects that arise from the flow of current in the circuit. Peltier found that when a weak current from an outside source is sent through a thermocouple one junction is warmed and the other cooled, and that the first junction is cooled and the other warmed when the current is reversed. Thomson found that an emf develops in a wire if one of its ends is at a higher temperature than the other. See also Temperature.

THERMODYNAMICS, *thur moh dy nam′-iks,* the theory of the relations between heat and mechanical energy and the means by which one form of energy is transformed into the other. Thermodynamics is concerned with the large-scale behavior of matter and not with the behavior of individual particles of atomic or molecular size and smaller. Principles of thermodynamics are applied in the design and operation of furnaces, refrigerators, heat pumps, electric-power plants, steam and gas turbines and engines, rockets, and jets of all types. These principles are also fundamental in the study of equilibrium processes in chemical and physical systems, of meteorology, and of atmospheres of the planets, sun, and stars.

The laws of thermodynamics are based on the well-known first and second laws, which are generalizations from experience. The *first law* is the statement that whenever mechanical energy is converted into heat, or heat into mechanical energy, the mechanical energy has a constant ratio to the heat energy, or is equal to the heat energy when both forms are measured in the same units. In a more general statement the law is extended to include electrical, chemical, and other forms of energy.

The *second law* is often stated as follows: Heat, of itself, never passes from one body to another at a higher temperature; and to produce such a transfer energy must be supplied from some outside source. For example, to transfer heat from a cool refrigerator to the warmer outside air requires the expenditure of electrical energy to operate a motor, or of heat from a gas flame. See also Conservation of Matter and Energy; Heat; Refrigeration.

THERMOELECTRIC′ITY. See Thermometer.

THERMOM′ETER, any instrument to measure temperature. The exact measurement of temperature is important to modern life in many ways. Heating and cooling systems for houses and other buildings must operate within certain temperature limits. The modern housewife knows that cookery requires exact temperature control for the best results. Refrigerators for everyday food storage, long-time cold storage, and quick-freezing also depend for their efficiency on the maintenance of set temperatures. In industry many technical processes require strict temperature control. These processes include nearly all large-scale chemical operations, including the cracking process used in gasoline refineries, the smelting of ores, and the manufacture and heat-treating of steel.

The various types of thermometers measure temperature by measuring some physical change produced by a change in temperature. Among these physical changes are change in volume (expansion), change in electrical resistance, change in brightness (of a luminous body), change in color, and the creation of an electrical difference of potential (voltage). The physical change most commonly used in thermometry is expansion. All gases and nearly all liquids and solids expand when heated. The most convenient and generally useful type of thermometer is the mercury thermometer.

Making a Mercury Thermometer. In making a mercury thermometer, a fine-bored glass tube is fused to a spherical or cylindrical glass bulb. The upper end of the tube, after being made plastic by the application of heat, is gently flared out to make a small funnel. Clean, distilled mercury is then poured down the funnel until the tube is nearly full. The thermometer bulb is heated until the mercury expands, completely filling the tube; and the upper end is then sealed off with a flame. As the mercury cools, it contracts, leaving only a vacuum (and a little mercury vapor) in the upper part of the tube.

The sealed tube of mercury is aged for several months to permit the glass to undergo whatever changes in volume take place after it has been subjected to high temperatures. It is then marked off in degrees (calibrated): the level of the mercury at two fixed points of known temperature is indicated on the tube, the space between the fixed points is divided into the desired number of degrees, and the scale is extended above and below these points with degrees of the same size. The fixed points generally used are the freezing point and the boiling point of distilled water at standard atmospheric pressure.

Temperature Scales. The scales commonly used today are the *Fahrenheit,* used in the household, in industry, and in weather reports for English-speaking countries; the *Centigrade,* now officially called *Celsius,* used in most countries where English is not spoken and in scientific work everywhere; the *Kelvin,* or *Absolute,* a modification of the Centigrade used in theoretical discussions involving absolute zero (see ABSOLUTE ZERO); and the *Absolute Fahrenheit,* sometimes used for the same purpose. The following diagram shows the relationships between these four scales.

Changing a temperature reading from one scale to another is a simple matter. To change from Centigrade to Kelvin, add 273; to change from Kelvin to Centigrade, subtract 273. To change from Fahrenheit to Absolute Fahrenheit, add 459; to change from Absolute Fahrenheit to Fahrenheit, substract 459. In changing from Fahrenheit to Centigrade, or the reverse, it must be kept in mind that, since the space between the freezing point and the boiling point is divided into 100 degrees on the Centigrade scale and into 180 degrees on the Fahrenheit scale, one Centigrade degree equals 1.8 or 9/5 Fahrenheit degrees; and a Fahrenheit degree equals 5/9 of a Centigrade degree. Since the freezing point is marked 32° on the Fahrenheit scale, the Centigrade reading, C, can be found from the Fahrenheit reading, F, by using the equation $C=(5/9)\ (F-32)$. Thus if the temperature is 59°F., it is 15°C., since 59 minus 32 is 27, 27 times 5 is 135, and 135 divided by 9 is 15. Centigrade may be changed to Fahrenheit by the equation $F=(9/5)C+32$.

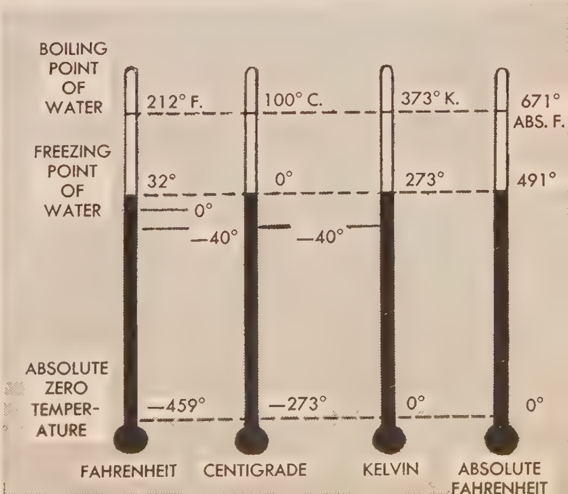
The Clinical, or Fever, Thermometer. The thermometer used in measuring body temperature is calibrated from 92° to 110°F. A small variation in temperature produces a comparatively large rise in the very thin mercury column. Just below the 92 mark is a constriction (narrowing) in the tube. When the mercury is expanding, it has no trouble passing this constriction, but when it contracts, surface tension causes the thread to break at this point. The upper part of the column stays in the upper portion of the tube until it is shaken down. As a result, the physician or nurse is able to make a leisurely reading.

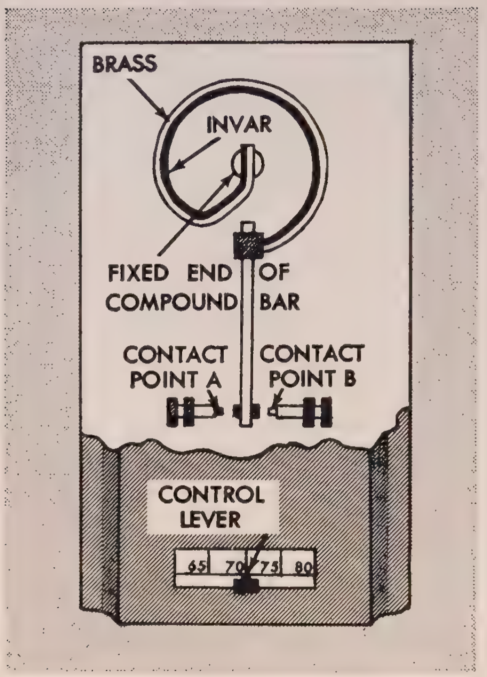
Limitations of Mercury Thermometers. Mercury freezes at –38.8°C. and boils, under standard atmospheric pressure, at 356.7°C. If the mercury is kept under pressure produced by some inert gas in the upper part of the tube, and if borosilicate glass (Pyrex) is used, the mercury thermometer will register temperatures up to 500°C. For temperatures below the freezing point of mercury, toluene, which freezes at –97°C., alcohol (–130°C.), or pentane (–200°C.) may be used. These liquids are generally colored red or blue for easier reading.

The coefficient of expansion of mercury is not entirely constant throughout the range of temperature for which it is used, and it is impossible to construct a glass tube of absolutely uniform bore. For these reasons, a mercury thermometer correct at the 0° and the 100° marks might not be exactly right at points in between. A really high-grade mercury thermometer has every degree mark separately etched on the glass tube by comparison with a standard hydrogen-type thermometer.

The Bureau of Standards in Washington, D.C., will mark a thermometer at the two fixed points for a nominal fee and will place additional degree marks for a few cents each.

Other Types of Thermometers. Of the two kinds of gas thermometers, constant pressure and constant volume, the constant-volume type employing hydrogen gas is most common. The volume of a given mass of gas kept





MOVEMENT OF THE CONTROL LEVER of the furnace thermostat alters the position of the contact points in relation to the pointer attached to the compound bar and thus changes the temperatures at which the draft of the furnace is automatically opened and closed.

at constant pressure, and the pressure of a given mass of gas at constant volume, is directly proportional to its temperature on the absolute scale. The resistance thermometer and the thermoelectric thermometer are both electrical devices; the platinum thermoelectric thermometer can be used at temperatures as high as 1500°C. (see Thermocouple). Other high-temperature thermometers, or pyrometers, include the optical pyrometer, which measures brightness; another form, which relates temperature to color; and Steger cones, which have known melting points.

Metal thermometers operate on the principle that different metals have different rates of expansion when heated. In the recording thermometer, or *thermograph,* the pointer of the thermometer has an inked stylus that traces a line on graph paper, recording daily or weekly temperature changes.

THERMONUCLEAR EXPLOSION. See Atomic Bomb; Atomic Energy.

THERMOPYLAE, *thur mop'ih lee,* a mountain pass in Greece, connecting ancient Thessaly with Lacris to the south, was made famous in 480 B.C. when Leonidas, King of Sparta, with a few thousand men, tried to hold back the great army of the Persian king Xerxes there. The pass, which lies between Mount Oeta and the Gulf of Lamia, was narrow, less than fifty feet wide, and was fortified by a wall. The small band of Greeks held it for two days, although they faced some 200,000 Persians. Then the Greek Ephialtes showed the enemy a way to cross the mountains and take the defenders of Thermopylae from the rear. As soon as it was clear that the defense of the pass was hopeless, Leonidas ordered all but a few of his command to leave. He himself and his Spartan and Thespian warriors fought until every man was killed. Their courage wrote a page of history that can never be forgotten. In 279 B.C. the pass was forced in the same fashion by Brennus of Gaul, after a long battle. During the centuries since the Persian Wars, the river Spercheius, which empties into the gulf near Thermopylae, has built up the plain by alluvial deposits, and the pass is now between one and three miles wide; in 1941, however, an invading German army was held in check there for several days by Australian and New Zealand troops. See also Leonidas; Xerxes (I).

THER'MOS BOTTLE. See Vacuum Bottle.

THER'MOSTAT. The housewife sets the dial of the oven of her modern gas or electric stove for the temperature she knows is best for roasting the meat or baking the cake. Then she turns on the gas or electricity. When the right temperature has been reached, a device automatically reduces the gas supply or electrical current, but raises it again if for some reason the temperature should fall too low. This device is a *thermostat.*

Thermostats control temperatures in various heating and cooling processes. In the modern home, they are used with a number of familiar devices, such as stoves and furnaces, refrigerators, electric irons, and electric blankets. In the automobile engine, a thermostat in the automatic choking device controls the richness of the fuel mixture of gasoline vapor and air supplied to the carburetor, increasing the proportion of gasoline when the engine is cold; another thermostat in the cooling system of the engine stops the circulation of the cooling liquid when the temperature of the engine is below a certain point; even the cigarette lighter on the instrument panel is thermostatically controlled. In industry thousands of different operations require set temperatures, which in almost every case are secured by the action of thermostats. This thermostat control may be coarse, giving the leeway of five or ten degrees permissible in some operations; or it may be fine, limiting the temperature change, especially in laboratory processes, to a small fraction of one degree.

How the Thermostat Works. The operation of the thermostat depends on the expansion that materials undergo when they are heated. The expanding substance may be a solid, a liquid, or a gas. The expansion can operate a valve, lever, cam, or other mechanical control; or it may make or break an electrical contact, in which case an electric motor or electromagnet is brought into play to operate the controls.

In a *compound-bar*, or *bimetallic*, thermostat, two metals that expand at different rates when heated are welded or riveted together. Iron and brass are often used, the brass expanding more than the iron. If such a bar is straight at 70°F., heating the bar above that point causes it to bend toward the iron side; cooling below that point causes it to bend toward the brass.

The *furnace* thermostat, designed to keep the temperature of a building within two or three degrees of some desired level, is generally of the compound-bar type. The essential features of its construction are shown in the diagram. When the temperature of the building falls a specified number of degrees below 70, the compound bar straightens, completing an electrical circuit at the contact point B, thus causing a motor to open the draft of the furnace. When the temperature rises above 70, a circuit is completed at the contact point A, causing another motor to close the draft. The compound bar shown in the diagram is made of brass and invar. Invar, an alloy of nickel and iron, expands and contracts scarcely at all when the temperature changes.

THESEUS, *the'suse* or *the'see us,* a hero of Greek legend, was the son of Aegeus, king of Athens. He succeeded his father on the throne of Athens, and because of his great deeds he became the Athenian national hero. He had many adventures. One of the first of these was his fight, on the island of Crete, with the Minotaur, a monster with the body of a man and the head of a bull. Because of a defeat in war, Athens was required to pay an annual tribute to Crete, sending seven youths and seven maidens to be sacrificed to the monster, which lived in the Cretan labyrinth. Theseus joined the group in the hope that he could destroy the Minotaur and free Athens from its debt.

In Crete, Ariadne, the daughter of King Minos, fell in love with Theseus and offered to help him. She gave him a ball of thread and told him to fasten one end at the entrance to the labyrinth and to unwind the ball as he searched for the Minotaur. After killing the monster he followed the thread back through the maze to freedom. When he sailed from Crete he took Ariadne with him, but for some reason he abandoned her on the island of Naxos, where Dionysus (Bacchus) later found her and married her. Theseus forgot that he had promised his father to replace the black sails of mourning with white ones as a symbol of victory. When the ship approached the coast, Aegeus saw the black sails and in despair threw himself into the sea, which afterward bore the name Aegean.

Theseus accompanied the Argonauts on their search for the Golden Fleece and fought the invading Amazons and the Centaurs. In later years he grew tyrannical and was finally banished from his kingdom. Phaedra was his wife. See also AEGEAN CIVILIZATION; ARGONAUTS; MINOS; MYTHOLOGY.

THESSALO'NIANS, EPISTLES TO THE, two letters written by the apostle Paul to the Christian church he had established in Thessalonica a short time earlier, on his second missionary journey. Paul had gone on to Athens and Corinth, and he sent Timothy back to Thessalonica to give help and encouragement to the new converts there. The first letter was probably written from Corinth about A.D. 50, soon after Timothy had rejoined Paul and reported to him that the Thessalonians were firm in their faith. In this Epistle, Paul praised them for their steadfastness and devotion and repeated some of the Christian principles he had taught them. The Second Epistle, which was probably written soon after the first, warned the Thessalonians not to expect the second coming of Christ immediately, and again urged them to work hard and to live truly Christian lives. See also PAUL, SAINT.

THESSALONIKE, *thes uh loh ni'kee.* See SALONIKA.

THESSALY, *thes'uh lih,* a district in northeastern Greece, consists mainly of rich plains enclosed by mountains. The Pindus range is on the west, and along the eastern coast are Mount Olympus, Mount Pelion, and Mount Ossa. In ancient times Thessaly was mainly agricultural, and its small cities were without much influence in Greek politics. Horses were raised on the plains, and by the time of Alexander the Great the Thessalian cavalry was famous. From the fourth century B.C. into the second, Thessaly was a dependency of Macedonia, and it later became part of the Roman Empire. With the rest of Greece, it was subject first to the Byzantine Empire and later to the Turks. When Greece achieved independence early in the nineteenth century, Thessaly was not included in the Greek state, but Turkey ceded it to Greece in 1881. The province is made up of two departments, Larissa and Trikkala. Volos is the principal port; Larissa, the chief town. The population of Thessaly is about 500,000.

THETIS, *the'tis.* See ACHILLES; ERIS.

THIAMINE, *thi'uh meen.* See VITAMINS.

GUSTAVUS ADOLPHUS OF SWEDEN prays for divine aid before advancing to victory and death in the Battle of Lützen in the Thirty Years' War.

THIRST, the sensation arising from a lack of sufficient water in the tissues and characterized by a craving for water. The only noticeable symptom of thirst is a dry or burning feeling in the mouth and throat, but the condition actually affects the deeper tissues of the body. Thirst commonly accompanies fever and occurs in diseases, such as cholera and diabetes, in which large amounts of fluid are lost from the body. Excessive perspiration and the eating of highly seasoned foods also may produce thirst.

Water comprises about 66 per cent of the entire body and is essential to the maintenance of life. It must be taken into the body in quantities great enough to offset the water lost through elimination. Experiments have shown that a complete lack of water will produce death within five to ten days. Thirst may be relieved not only by drinking water but also by injecting fluid into the veins. When unexplained thirst persists, a physician should be consulted.

THIRTY-NINE ARTICLES, The, a statement of the basic doctrine and practice of the Church of England. They were based on the forty-two articles of religion of the Reformation English Church published in 1553 by Edward VI and abrogated the same year when the Catholic Queen Mary came to the throne. After Protestant worship had been restored under Queen Elizabeth (1559), Church leaders revised the articles, reducing them to thirty-nine. Parliament ratified the new articles in 1562; slight revisions were made in 1571 and 1604. Designed as a test of orthodoxy at a time when the religious controversy was at its height, the Thirty-nine Articles represented a compromise among the chief parties in the new Church, some of whom were Lutheran, some Calvinistic, and others of purely English origin. In the United States, the Methodist Episcopal Church adopted twenty-five of the articles at its organization in 1784; and the Protestant Episcopal Church, after breaking away from the parent body, adopted the Thirty-nine Articles in 1801 with minor changes made necessary by the difference in relationship of church and state in the two countries. See also England, Church of; Episcopal Church.

THIRTY YEARS' WAR, a desolating war in Europe that dragged on from 1618 to 1648. It was part of the great struggle between Protestantism and Catholicism, but matters of power, wealth, and political expediency were also involved, and from the beginning the religious question was not the only issue. In broad outline the antagonists were, on the one hand, the Holy Roman

Emperor, sanctioned by the Church and backed by Spain and the German states belonging to the Catholic League; and on the other hand the Protestant countries of the North (Sweden, Denmark, the Netherlands, and the German states in the Protestant Union) and Catholic France, whose leaders were primarily interested in curbing the power of the Hapsburg emperors and in acquiring territory. The armies on both sides contained many professional soldiers, or mercenaries. Germany, which was the principal scene of the war, was made up of many small states under the nominal rule of the emperor. In some of the Protestant states the people were Calvinist rather than Lutheran, and when the crisis came the Lutherans of the Protestant Union were not eager to support the Calvinists.

The Bohemian Period. The war began when Ferdinand, Duke of Styria, an ardent Catholic educated by the Jesuits, became King of Bohemia and Hungary and, shortly afterward, Holy Roman Emperor. Many of the Bohemians were Protestant, and when they were forbidden to follow their faith they rose in revolt. They refused to accept Ferdinand as their king and offered the crown to Frederick V, the Elector Palatine. Frederick was a Calvinist, and many Lutheran Germans withheld their support. Maximilian, Duke of Bavaria and head of the Catholic League, had a fine army commanded by the famous general Tilly, and in 1620 these troops defeated the Bohemians in the Battle of the White Mountain near Prague. Ferdinand then wiped out Protestantism in Bohemia. He also turned over the Palatinate to Maximilian (1623), as a reward of victory.

The Danish Period. In 1625 the German Protestants enlisted the aid of King Christian IV of Denmark, and the struggle continued; but Ferdinand now had an Imperial army under the command of the Bohemian general Wallenstein, as well as the forces under Tilly. In 1629 Christian was obliged to make peace with the Emperor. Ferdinand issued an Edict of Restitution, ordering the Protestants to return to the Catholic Church all church property acquired after the Peace of Augsburg in 1555. Wallenstein's ambitions began to alarm both the Germans and the Austrians, who feared that he might intend to set himself up as king in Germany or Bohemia. Maximilian therefore succeeded in having Wallenstein dismissed, and General Tilly was given command of the Imperial army.

The Swedish Period. The third period of the war began in 1630, when Gustavus II Adolphus, King of Sweden, took up arms against Ferdinand. The French, who wanted to see the Hapsburg power crushed, agreed to help finance the Swedish army. Gustavus Adolphus was anxious to fight for the Protestant cause, and he also wanted to improve Sweden's position in the Baltic. He was a fine soldier, and he defeated Tilly twice — at Breitenfeld, near Leipzig, and again on the Lech River, where the general was killed. Wallenstein was recalled to head the Imperial army, and in November, 1632, Gustavus Adolphus fell at Lützen, although the Swedes were victorious.

The war was carried on under the direction of the Swedish chancellor Oxenstierna and other Swedish leaders, but when the Swedish army was routed at Nördlingen the Elector of Saxony, who had been an ally of Gustavus Adolphus, made peace with Ferdinand at Prague (1635). Wallenstein was assassinated because his popularity, ambition, and ability seemed a danger to the empire. Most of the German states signed the peace, but by this time nearly all of Europe had become involved in the struggle for power between France and Austria.

The French-Swedish Period. The last thirteen years of the war saw French armies in the field along with the Swedish forces, Turenne and Condé leading the French, Torstenson and Wrangel the Swedes. Spain tried to retake the Dutch provinces and failed. Ferdinand died in 1637, and his son was made emperor as Ferdinand III.

From the beginning, the Thirty Years' War was marked by extreme cruelty and violence. The mercenary armies seized what they needed from the land, despoiling Protestant and Catholic alike. Germany was devastated, and the population was decreased by half. Cities were sacked by victorious troops, and the inhabitants were put to death. When Magdeburg was taken by Tilly's army in 1631, the city was looted and then burned; some twenty thousand people were killed. The massacre shocked even those hardened to scenes of horror. By 1645 all Europe was sick of war, but it took three years for representatives of the various belligerents to arrange the Peace of Westphalia (1648). The war ended with the German states largely free from the overlordship of the Emperor. Protestantism was firmly established in parts of Germany and the Netherlands, but was wiped out in Austria and Bohemia. France acquired Alsace, a territory that later became a bone of contention with Germany.

Related Articles. For further information consult the following titles:

Germany
Gustavus (II, Sweden)
Leipzig, Battles of
Lützen, Battles of
Reformation
Tilly, Johann Tserclaes, Count of
Wallenstein, Albrecht Eusebius Wenzel von
Westphalia, Peace of

THISBE, *thiz'bee.* See Pyramus and Thisbe.

Brown Brothers

THOMAS À KEMPIS spent his entire adult career in seclusion but won lasting, worldwide fame with *The Imitation of Christ.*

THISTLE, *this''l*, the common name of several plants with spiny leaves. The true thistles are members of the composite group of plants, relatives of the daisy. They have deeply lobed, spiny leaves, and the bases of their flower heads also are usually spiny. Nearly all, including the *Canada thistle,* are native to the Old World, but many have become naturalized in North America. Most of them are obnoxious weeds. Annual and biennial thistles may be controlled by cutting them before they produce seeds. But the Canada thistle, one of the most harmful weeds of North America, is a perennial that spreads by means of underground rootstocks as well as by seeds, and so it is more difficult to destroy. Constant mowing will eventually starve the rootstocks, but the plants may be eradicated in less time and with less labor by means of herbicides such as 2,4-D (see HERBICIDES).

Among other plants called thistles are the *blessed thistle* and the *globe thistle,* which are cultivated for their flowers, and the *golden thistle,* grown for its edible roots. All three are composite plants. The *Russian thistle* is a tumbleweed of the goosefoot family (see TUMBLEWEED). The thistle is the floral emblem of Scotland.

See also COMPOSITE PLANTS.

Scientific Names. Canada thistle, *Cirsium arvense;* Russian thistle, *Salsola kali;* Scotch thistle, *C. acaulis.*

THISTLE, ORDER OF THE, a Scottish order of knighthood, also called the Order of St. Andrew. It was inaugurated by James V in 1540, re-established briefly by James VII (James II of England) in 1687, and restored by Queen Anne in 1703. A law of 1827 limits it to sixteen members of the Scottish nobility besides the king. Its insignia is an eight-pointed silver star suspended on a green ribbon; its symbols include St. Andrew's cross and the Scottish national emblem. Its motto is *Nemo me impune lacessit* (No one injures me with impunity).

THOMAS, NORMAN MATTOON (1884-), an American Socialist leader, was born at Marion, Ohio. After graduation from Princeton University and, in 1911, from Union Theological Seminary, he served as a Presbyterian minister, resigning in 1918 because of his pacifist stand during World War I. He founded and edited the magazine *World Tomorrow* (1918-21) and became active in many fields of social reform. In every presidential election from 1928 to 1948, he was the Socialist candidate for President, and until 1950 he acted as the national leader of the Socialist party. An impassioned orator and prolific writer, he exerted great influence as a spokesman for many causes which were later adopted by the major political parties in the United States. Among his many books are *America's Way Out* and *What Is Our Destiny?*

THOMAS À BECKET. See BECKET, THOMAS À.

THOMAS À KEMPIS (1380-1471), a German monk and the probable author of *The Imitation of Christ,* was born in the town of Kempen, near Düsseldorf, Prussia. His name was Thomas Hamerken, but at school in Holland he was called Thomas-from-Kempen, or Thomas à Kempis. At twenty he entered the convent of Mount St. Agnes near Zwolle, Holland, and the rest of his long life was happily spent copying manuscripts and writing on religious subjects. *The Imitation of Christ* (*Imitatio Christi*), which is generally ascribed to him, is one of the most famous of Christian devotional writings. It has gone through thousands of editions in many languages.

THOMP'SON, FRANCIS (1859-1907), English poet and religious mystic, thought of becoming a doctor like his father, but in 1885 gave up the study of medicine and went to London to find a job. He went through years of hardship, poverty, and illness before his poems finally found an audience. The first volume, published in 1893, contained his most famous poem, "The Hound of Heaven."

Illustration by Gregory Orloff, from *The Literature of the United States*, by Blair, Hornberger, and Stewart; Scott, Foresman and Company

THOREAU'S HOME in Concord is shown at the right. At the upper left, the famous naturalist watches a fox. Below is his study at Walden, and in the center is his hut near Walden Pond.

THOM'SON, JAMES (1700-1748), Scottish poet and dramatist, was born at Ednam, Scotland, and attended the University of Edinburgh. In 1725 he went to London and within five years published a group of poems called *The Seasons,* his most important work. He also wrote a number of plays, but his ability as a dramatist was limited. *The Masque of Alfred* (1740), which contained the famous song, "Rule Britannia," was written by Thomson in collaboration with David Mallet. His last important work, thought by some to be his masterpiece, was a romantic allegory, *The Castle of Indolence* (1748). Thomson is considered a forerunner of the Romantic poets of the early nineteenth century because of his realistic, emotional treatment of nature in *The Seasons.* In *The Castle of Indolence* Thomson used the pattern and the meter of Edmund Spenser's *Faerie Queene.* Like *The Seasons,* this poem reveals Thomson's unusual sensitivity and remarkable powers of description.

THOMSON, SIR JOSEPH JOHN (1856-1940), famous British physicist, made important contributions to man's understanding of matter through his theoretical and experimental work. He was born in Manchester and graduated from Trinity College, Cambridge. In 1884, at the age of twenty-eight, he was admitted to the Royal Society and was made Cavendish professor at Cambridge, holding that position until 1919, when he was given a research professorship. Thomson built up a famous school of experimental physics to which students and advanced scientists from all over the world came to carry out research under his guidance. Many of those who studied under him became outstanding physicists, and several, including Ernest Rutherford, later won Nobel prizes, as did Thomson himself in 1906. He was knighted in 1908 and became president of the Royal Society in 1915. He was buried in Westminster Abbey.

During the 1890's, Thomson carried out investigations which led to his discovery of the electron and thereby furnished new knowledge of the structure of the atom. Earlier, he had proved that the motion of an electrically charged body affects its mass; in 1910, by applying magnetic and electric fields to a stream of positively charged atoms, he discovered that neon gas consists of groups of atoms having different masses. Such groups of atoms in an element are known as *isotopes.* Works by Thomson include *The Conduction of Electricity Through Gases* (1903) and *The Electron in Chemistry* (1923). See also ATOM.

THOMSON, WILLIAM. See KELVIN, WILLIAM THOMSON, BARON.

THOR, *thawr,* Norse god of thunder, was the son of Odin and Frigga. The ancients believed that the rumblings of the skies were caused by the wheels of his mighty chariot. Thor had a great hammer which returned to his hand after it had been hurled. With this weapon the god frequently waged war upon the enemy giants. In the final contest between the gods and the giants, Thor slew the serpent of Midgard; but he was fatally poisoned by the venom exhaled from the serpent's mouth. Thor was pictured as a strong, vigorous being with a red beard. Among many Scandinavian peoples he was more worshiped than Odin, king of the gods. His hammer was a weapon similar to Zeus's thunderbolts. Thursday, originally "Thor's day," was named in his honor. See also MYTHOLOGY.

THO'RAX. See ABDOMEN; CHEST; LUNGS; SKELETON.

THOREAU, *thor'oh,* HENRY DAVID (1817-1862), American writer and naturalist, is considered one of the most interesting personalities and one of the most genuine individualists that America has produced. He was born in Concord, Mass., and when he graduated from Harvard in 1837 he was already known as an extremely independent and rather eccentric young man. He joined

Thorvaldsens Museum, Copenhagen

THORVALDSEN MADE A STATUE OF HIMSELF with mallet and chisel in hand.

his brother John in the operation of a private school in Concord, and in 1839 he and his brother made a boat trip which Thoreau later described in *A Week on the Concord and Merrimack Rivers* (1849). The school was closed in 1841 because of John's failing health. About this time Thoreau formed a close friendship with Ralph Waldo Emerson and became a member of the Transcendentalist group in Concord (see TRANSCENDENTALISM). He spent some months as a member of the Emerson household, supporting himself by acting as a general man of all work.

In 1845 Thoreau built a hut on the shore of Walden Pond in the woods near Concord and he lived there for two years before returning to the family home. *Walden, or Life in the Woods* (1854), the record of his experiment in plain living and high thinking, has become a literary classic. Thoreau was always deeply interested in nature and outdoor life, and he made many careful observations of natural phenomena, but the scientific importance of *Walden* is secondary. The book is a philosophical document expressing the thoughts and emotions of a man who sought to shake himself free of the pressures of modern society and go back to individual living governed by moral principles. Thoreau's prose style is ranked with the best of American writing.

During Thoreau's stay at Walden, he spent a night in the Concord jail for nonpayment of the poll tax. In this instance he was protesting against the government's policy on slavery, but his doctrine of individualism is expressed in his essay "Civil Disobedience" (1849). In 1859 he threw all his energies into the defense of John Brown, the famous abolitionist. Thoreau died of tuberculosis when he was forty-five, and most of his books were edited and published after his death. They include *Excursions, The Maine Woods,* and *Cape Cod.* Henry Seidel Canby's *Thoreau* is a good biography of the great American individualist.

THORIUM, *tho'rih um,* a rare metallic element discovered in 1828. The largest supplies of thorium occur in sands derived from the mineral monazite, which is a phosphate of the rare-earth metals (cerium metals) that also contains thorium silicate; some thorium is obtained from the mineral thorite. Most of the world's supply of monazite sands comes from Brazil, India, and East Africa.

Thorium is used to a limited extent in alloys. A small amount of thorium is alloyed with a heat-resistant nickel-chromium alloy to increase its durability. Thorium oxide is a white solid that can be heated to a very high temperature without melting. The Welsbach gas mantle, which becomes brilliantly luminous when heated in a gas flame, consists of a mixture of 99 per cent thorium oxide and 1 per cent cerium oxide.

Thorium is one of the naturally radioactive elements whose atoms disintegrate spontaneously by emitting alpha particles (see ATOM). Like uranium atoms, thorium atoms are fissionable; that is, they can be made to split into two or more simpler atoms with the release of great amounts of energy. Mesothorium, a product of the radioactive disintegration of thorium, is not thorium but an isotope of radium (see ISOTOPES). The symbol for thorium is Th, the atomic weight 232.12, the atomic number 90. The pure metal has a specific gravity of 11.3 and melts at 1845°C.

THORN APPLE. See HAWTHORN; STRAMONIUM.

THOROUGHWORT, *thur'oh wurt.* See BONESET.

THORVALDSEN, *toor'vahl s'n,* BERTEL (1768-1844), a famous Danish sculptor, was born in Copenhagen, where his father, an Icelander, worked as a woodcarver. Thorvaldsen went to Rome as a young man and came under the influence of Antonio Canova and the movement for a return to classicism in art. He was soon very successful and received many commissions. He executed a number of statues for the Church of Our Lady in Copenhagen and designed the famous "Lion of Lucerne," a monument in the city of Lucerne. Many examples of his art are in the Thorvaldsen Museum, which he gave to the city of Copenhagen. The sculptor's tomb is in the museum courtyard. See also CANOVA, ANTONIO; LION OF LUCERNE.

THOTHMES, *thohth'mehs.* See THUTMOSE.

THOUGHT is activity of the mind. It involves *memory;* the use of *concepts,* or mental pictures of things, persons, qualities, events, or abstractions like relationships; and the ability to relate one concept to others, or *reason.* A word is a symbol for a concept, and thinking is generally put into words, even though the words may be unspoken. Thinking may be a very simple kind of daydreaming that goes along with little effort; or it may be a strictly controlled, intense study of a difficult problem. Ordinary thinking is usually something more than daydreaming and less than the solving of difficult problems. The principal processes of thought seem to take place in the cerebral cortex, a thin layer of gray matter that covers the cerebrum (see BRAIN).

Thought is the linking of many concepts or ideas into an organized pattern. A thinking person learns to *generalize,* or to recognize similarities in certain concepts that group them together, and also to *differentiate,* or to recognize differences in objects that belong to the same class. By these processes he organizes his experience and draws some general conclusions, or principles, from it; and when he is faced with a new situation, he calls upon one or more of these principles to guide him.

A person who is doing creative thinking such as that used in scientific research collects all the available material that seems to have a bearing on the problem he is trying to solve and rejects everything that proves to be irrelevant. He then tries to find the possible relationships between the facts that he has collected and looks for a pattern into which they will fit. When he has discovered a possible pattern, or *hypothesis,* he tests it in every possible way, searching for any facts that do not fit. If he finds nothing to contradict his theory, he accepts it provisionally, with the understanding that some new discovery may still prove it wrong.

No individual has exactly the same concepts as another person; no two people see exactly the same image when a word is spoken. Most thoughts are colored by instinct and emotion as well as by experience and habit, and all such factors may be barriers to logical reasoning. The greatest thinkers do not allow their minds to be clouded by prejudices, and they do not accept any conclusion without testing it by every possible means. See also JUDGMENT; LOGIC; PSYCHOLOGY; REASON.

THOUSAND ISLANDS, a group of more than 1,500 islands scattered in the broad reach of the St. Lawrence River between Kingston, Ontario, and Brockville, about forty miles to the northeast. Beautiful scenery and a fine climate have made this region a popular summer resort. Canadians and Americans have built summer homes on many of the rocky, wooded islands. There are many small provincial and state parks on both sides of the international boundary, and on the Canadian side, near Kingston, is the St. Lawrence Islands National Park. An international toll bridge eight miles long runs from the New York shore to Grindstone Island and across to a point near Gananoque, Ontario. Alexandria Bay, New York, is a well-known vacation center.

THRACE, *thrase,* in ancient times the territory lying between Macedonia and the Black Sea and extending as far north as the Danube, was a region of grain fields, mountains, and grazing lands. The Greeks thought that the wild Thracian tribesmen, who were usually fighting, were barbarians. The Thracian horses were as famous as those of Thessaly. Thrace was conquered by Macedonia, and in the first century became a Roman province. Modern Thrace, the southern part of the ancient territory, is divided between Greece and Turkey. The eastern part, north of the Hellespont and the Sea of Marmora, is Turkish. Istanbul (once Constantinople and, still earlier, Byzantium) is its chief city. Western Thrace is the northeast corner of Greece; it consists of two departments, Evros and Rhodope.

THRASH'ER, a genus of North American songbirds, related to the catbirds and mockingbirds. The most common species, the *brown* thrasher, is a little larger than a robin, with a long tail and a sharp bill, curving downward. The upper parts are reddish brown, and the white breast is heavily streaked. Thrashers prefer undergrowth and low bushes, sometimes building their nests in tangled garden shrubbery. Two broods

A BIRD OF THE WOODS, the wood thrush often pours out its song in the early evening.

are usually raised each summer, and the parents share in feeding the young. These birds breed throughout southeastern Canada and the eastern United States, wintering in the Southern states. The thrasher's song is varied, rich, and musical. Like the mockingbird's, it contains imitations of other birds.

Scientific Name. Brown thrasher, *Toxostoma rufum.*

THREAD, in general, is any fine strand of textile fibers, but specifically one consisting of two or more yarns, or cords, firmly twisted together. It is used mainly for sewing. *Cotton* thread, made of combed and carded fibers, comes in a wide range of sizes numbered from 8, the coarsest, to 200, the finest. Six-cord cotton thread, or spool cotton, is the strongest. It is made of three two-cord strands. Mercerized cotton thread is generally three-ply and is not highly twisted. *Linen* thread, which is coarser than cotton, is tightly twisted and waxed; it is used to sew shoes. *Sewing silk,* usually six-cord, is commonly found in one size called *A*. Eight-cord *buttonhole twist* is heavier and stronger. *Nylon* thread, finer and stronger than silk, has also been developed. See also COTTON; LINEN; NYLON; SILK; TEXTILES.

THREAD′WORM, a name given to certain roundworms belonging to the phylum Nemathelminthes. It is given especially to the pinworm, which is distributed throughout the world and is particularly abundant in warm climates. A parasitic species, it lives in the human intestine. The male and female worms, which reach a maximum length of half an inch, mate inside the host; the female then migrates through the intestine, finally passing out through the anus, where the eggs are deposited. These migrations cause extreme itchiness, and when the host scratches himself, he picks up the eggs on his fingers. If the eggs accidentally reach his mouth, he reinfects himself; or, if he handles objects that are used by others, the infection may be spread further. After the eggs have been swallowed, they are carried into the small intestine, where they hatch into larvae. The larvae move to the cecum and appendix, attach themselves, and grow to maturity. Pinworms may cause intestinal inflammation, producing symptoms similar to appendicitis; in children, they may bring on convulsions. The infection may be cured by treatment with either gentian violet or hexylresorcinol.

THROMBO′SIS, CORONARY. See CORONARY THROMBOSIS.

THRUSH, a large family of songbirds which includes the nightingales, wood thrushes, robins, bluebirds, and others. Birds of the thrush family eat worms, insects, seeds, and berries or other fruits; they have speckle-breasted young; and they are among the finest singers in the world. In Europe the nightingale, the song thrush, and the missel thrush are the most famous songsters.

In North America the name thrush is usually given to the wood thrushes, brownish birds with spotted breasts. The *wood* thrush and the *hermit* thrush are the greatest singers. Both birds are generally olive brown above, with a black-spotted white breast. The wood thrush has a rufous head; the hermit, a reddish-brown rump and tail and a white eye ring. The *veery* is generally tawny above, and its white breast is faintly spotted. Most of the thrushes breed in Canada and the northern United States, wintering from the Southern states into South America. Their nests are commonly on the ground or in low bushes in wooded areas.

Scientific Names. Wood thrush, *Hylocichla mustelina;* hermit, *H. guttata;* veery, *H. fuscescens.*

THUCYDIDES, *thoo sid′ ih deez,* a famous Greek historian, was born between 470 and 455 B.C. and died about the year 400. His father, an aristocratic Athenian, owned valuable gold mines in Thrace, and Thucydides probably spent some years of his life there. In 424 B.C., about seven years after the opening of the Peloponnesian War, Thucydides was one of two generals in command of Athenian troops in Thrace. Because he failed to reach Amphipolis in time to save the city from the Spartans, his command was taken from him and he was exiled from Athens. This exile, according to Thucydides, gave gave him the opportunity to write his *History of the Peloponnesian War,* a masterpiece consisting of eight books.

Thucydides' *History* is an impartial, carefully studied record covering the first twenty years of the war, from 431 to 411 B.C. It is made dramatic by the addition of dialogue and direct quotations from speeches, such as Pericles' funeral oration for soldiers killed in battle. The author's purpose was not only to tell the story of this particular war but to study it as an example of war in general and to find out why men went to war at all. He came to the conclusion that power creates a demand for more power, and that war has its origin in greed.

THUGS, a well-organized society in India whose members for some six centuries strangled and plundered wayfarers. It was essentially a caste which performed certain religious rites; in the fall of the year its members murdered their victims as sacrifices to the goddess Kali. Holy men, members of low castes, and women were usually not molested. About 1830 the British Government began a campaign which eventually brought the society to an end. The name is now popularly applied to hardened criminals.

THULIUM, *thoo′lih um,* a chemical element belonging to the erbium family of rare-earth metals in group III A of the periodic table (see PERIODIC TABLE). The pure metal has not been isolated because of its chemical similarity to the other elements of the family: dysprosium, holmium, and erbium. But thulium oxide (thulia), thulium chloride, and other salts, all greenish in color, have been prepared. Thulium was discovered in 1879. Its valence is + 3, its atomic number 69, and its atomic weight 169.40.

THUNDER, or **THUNDERSTORM**. See LIGHTNING; STORMS.

THUR′BER, JAMES GROVER (1894-), American humorous author and cartoonist, was born in Columbus, Ohio, studied at Ohio State University, and for some years worked as a reporter in Columbus. After spending a year in Paris on the staff of the Chicago *Tribune* (1924-25), he settled in New York. He began contributing articles, stories, and drawings to the *New Yorker* in 1926, and was on the staff of the magazine until 1933. Thurber produced remarkable drawings, although he was almost blind. He also wrote stories, sketches, children's books, and, with Elliott Nugent, *The Male Animal,* which was highly successful both as a play and as a motion picture. Among Thurber's best-known works are *The Owl in the Attic, The Seal in the Bedroom, My Life and Hard Times, My World — and Welcome to It, The White Deer,* and *Men, Women, and Dogs.*

THURSDAY, the fifth day of the week, named after Thor, the ancient Norse god of thunder. *Maundy,* or *Holy, Thursday,* the day preceding Good Friday, is associated with Christ's Last Supper. In Australia *Black Thursday* refers to February 6, 1851, the day the great fire swept the colony of Victoria. The fourth Thursday of November is Thanksgiving Day in the United States.

THUTMOSE, *thoot mo′suh,* or **THOTHMES**, *thohth′mehs,* the name of several Egyptian rulers belonging to the Eighteenth Dynasty (1580-1350 B.C.). **Thutmose I**, the third king of the dynasty, was the father of **Queen Hatshepsut**, the only woman ruler in early Egypt. Before he died, he recognized his daughter as co-ruler of the kingdom; and she held the real power during the brief reign of her half brother, **Thutmose II**. Thutmose II was followed by his son, **Thutmose III**, who reigned from about 1500 to 1450 B.C. Hatshepsut was co-ruler with her nephew until her death about 1480 B.C.; she was also his wife. Thutmose III was the first world conqueror. In twenty years of campaigning he extended the Egyptian Empire along the eastern Mediterranean, conquering Syria, Phoenicia, Palestine, and possibly Crete. He enriched his capital, Thebes, with fine temples and many obelisks, enlarged the Great Temple of Karnak, and had an account of his deeds inscribed on the temple walls. One of the obelisks he erected is now in New York, and another is in London. They are misnamed "Cleopatra's Needles." See also CLEOPATRA'S NEEDLES; THEBES.

THYME, *time,* a small genus of perennial herbs of the mint family, some species of which are cultivated for their richly fragrant leaves and as border plants in gardens. The *common* thyme, native to the Mediterranean area, is a branching plant from six to twelve inches tall. Its leaves are used to flavor foods. From the leaves is distilled an oil which is used in perfumery. *Thymol,* a substance used as a disinfectant and as a vermifuge, is extracted from the oil. The *creeping* thyme, a spreading shrub which roots at its stems, is less aromatic than the common thyme but is similarly used.

THY′MUS GLAND. See GLANDS.

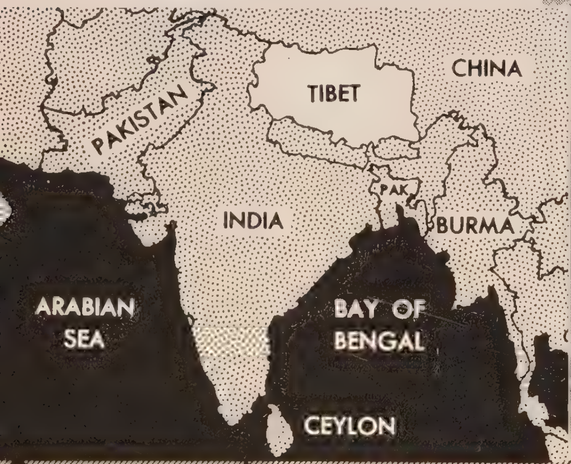
THY′ROID GLAND. See GLANDS.

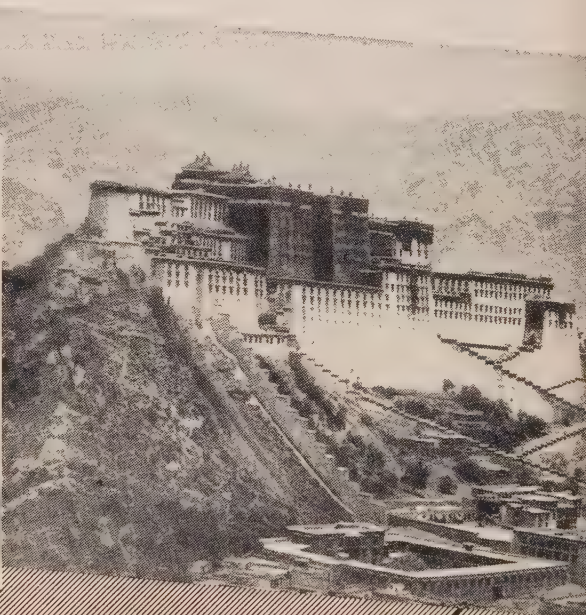
TIBERIUS, *ty beer′ih us,* SEA OF. See GALILEE, SEA OF.

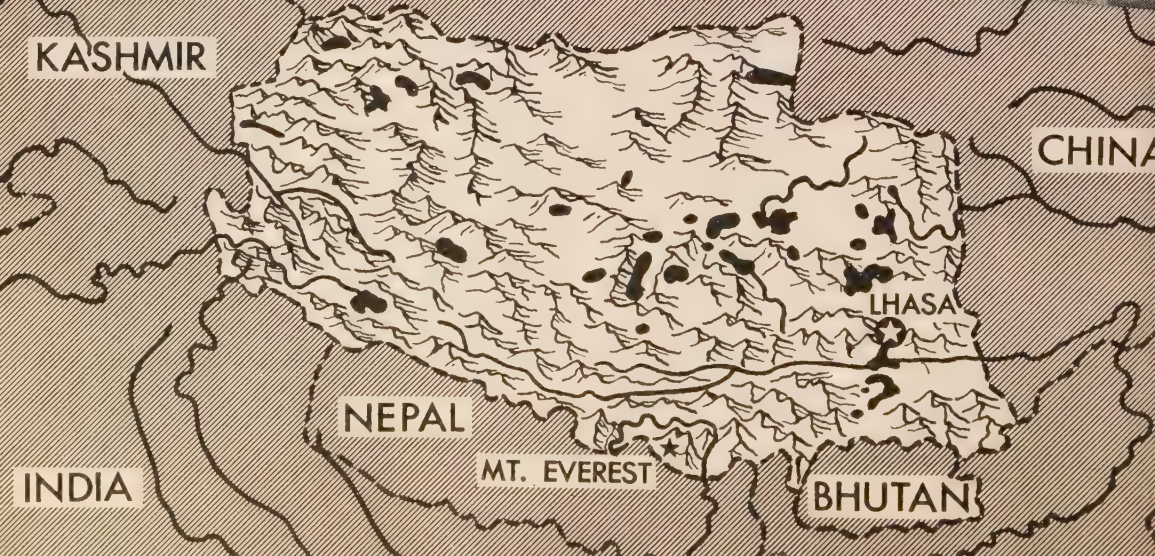
TIBERIUS, *ty beer′ih us* (42 B.C.-A.D. 37), Roman emperor, was the son of Tiberius Claudius Nero and his wife Livia. Livia was divorced by her husband so that she could marry the Emperor Augustus, and, as the stepson of Augustus, Tiberius was given important posts. He had a distinguished career as a soldier, with war service in many provinces of the empire. In 11 B.C. Augustus forced him to divorce his first wife, Agrippina, and marry the Emperor's daughter Julia. This second marriage was unhappy, and perhaps because of these personal troubles Tiberius retired from public life and went to live for some years on the island of Rhodes. When he came back to Rome, the two grandsons of the Emperor were dead, and Augustus decided to make Tiberius his heir. The reign of Tiberius, who succeeded to the throne in A.D. 14, was marked by good administration along the lines laid down by Augustus, but there was much turmoil and violence in Rome. Tiberius left the city in A.D. 27 and took refuge on the island of Capri, leaving the reins in the hands of Sejanus, his principal adviser, who was prefect of the Praetorian Guard. Sejanus used his power to prosecute any rivals as traitors to the state and planned to overthrow Tiberius. The Emperor discovered the plot, and had Sejanus executed in 31. When Tiberius died in 37, he was succeeded by his brother's grandson, Gaius Caesar, who reigned as Caligula.

TI′BER RIVER (Italian *Tevere*), the principal river of central Italy. The Tiber rises in the Apennines, near Arezzo, and flows generally toward the south for about 250 miles, emptying into the Tyrrhenian Sea sixteen miles below Rome. In the capital, where the river makes three wide bends, the Tiber is about 200 feet wide and perhaps sixteen feet deep. Because it picks up quantities of yellow mud and sand along its course, it is sometimes called the "yellow Tiber." It enters the sea by two mouths. Ostia, in the delta, was the port of ancient Rome; but the alluvial deposits made by the Tiber have built out the shore, leaving the town several miles inland.

TIBET′, a religious kingdom of Central Asia, is bounded by China on the north and east; by Kashmir on the west; and by Bhutan, Nepal, and India on the south. The area of Tibet is estimated to be 400,000 square miles. Before 1944, when China exacted boundary adjustments on the east, its







LAKES DOT THE MOUNTAINOUS SURFACE of mysterious Tibet, which now serves Red China as a strategic outpost on the border of India. At the right is the imposing residence of the Dalai Lama at Lhasa, Tibet's isolated capital.

By Burton Holmes from Ewing Galloway

area was about 470,000 square miles.

Occupying part of a vast, wind-swept plateau with an average elevation of 16,000 feet above sea level, Tibet is the highest country in the world. The principal means of entering this isolated country is by mule train, through lofty, twisting passes of the Himalaya, which extends for some 1,600 miles along the southern border. The vast, arclike barrier formed by the giant, snow-clad Himalayan peaks reaches its climax in Mount Everest (29,141 ft.), the highest point on the earth's surface. The backbone of Asia is formed by the Kunlun Mountains, which range for about 1,500 miles along the northern edge of the Tibetan Plateau. To the south of these mountains is the bleak, desolate, and largely unexplored region known as Chang Tang.

The Kailas Mountains in the western part of Tibet are the source of three of India's rivers — the Indus, the Sutlej, and the Brahmaputra. The Salween River of Burma rises in the Tanglha Mountains in the east. Scattered over the plateau are countless lakes, some of them salt lakes with no outlets. The most habitable section is the fertile, well-watered, and protected valley of the Tsangpo, or Upper Brahmaputra, which extends across the southern part of Tibet. In this valley, which escapes the bitter cold and prolonged droughts of the highlands, are located the capital, Lhasa, and the two trading centers, Gyangtse and Shigatse.

Tibet is a very sparsely populated country, with an estimated population of only four million. Like the Chinese, the Tibetans are Mongolians. Their religion, called Lamaism, developed out of Buddhism, which was introduced from India in the seventh century. For almost seven hundred years the government has been a theocracy, headed by the Dalai, or Grand, Lama, who is both the spiritual and the temporal ruler. Below him in the Lamaist hierarchy are the Teshu, or Panchan, Lama and some seven hundred senior lamas, who are believed to be living incarnations of minor Buddhist divinities. About one fifth of the population are monks and nuns.

Most Tibetans are primitive farmers and nomad herdsmen. Instead of tilling and irrigating their own soil, the farmers work under a feudal system which compels them to support the privileged priests and to labor on the estates of the hereditary nobles. Barley, soya beans, peas, wheat, turnips, cabbages, and orchard fruits are the chief crops. Sheep graze on the mountain slopes; their wool is used in the manufacture of cloth and carpets. The yak, which has great importance as a draft animal in the highlands, provides hair which is made into tent cloth and into felt for hats. Yak butter serves as lamp oil and is used in buttered tea, Tibet's national beverage, and yak hides cover the coracles which provide the principal means of water transport. Other livestock includes goats, ponies, donkeys, mules, and hogs.

Tibet is believed to have considerable mineral wealth, but only gold, iron, salt, niter, potash, and borax are mined. Much of the gold dust and such semiprecious stones as turquoise, aquamarine, and lapis lazuli are used in making jewelry. Caravans carrying tea and other trade goods enter Tibet from both India and China.

History. Tibet was conquered by the Mongols early in the thirteenth century. Kublai Khan, the first Mongol emperor of Greater China, was converted to Lamaism and bestowed limited self-government on Tibet by recognizing the supremacy of the abbot of the Sakya lamasery, thus establishing Tibet's system of rule by priest-kings. In the sixteenth century one of the abbots, who had become known as the Dalai, or All-Embracing, Lama, proclaimed himself the reincarnation of the Mercy Spirit of Buddha. He thus instituted the system of transmigration by which the souls of the higher lamas are believed to pass on death to newborn male children.

Putting down a rebellion of Tibetan tribes in the mid-eighteenth century, the Manchu emperors made Tibet an outer dependency of China, and for almost two hundred years the Chinese Government handled the country's foreign affairs. In 1904 a British military expedition imposed the Anglo-Tibetan Convention, in which Tibet granted important trade concessions to British India and thus became less isolated in its relations with the outer world. During the Chinese Revolution of 1911-12 the Tibetans ousted the Chinese commissioners and occupation troops in Tibet and asserted their independence. They developed a form of self-government which vested the executive power in the Dalai Lama and the legislative power in a national assembly composed of lay and ecclesiastical members. The thirteenth Dalai Lama died in 1933. His successor, the fourteenth Dalai Lama, was installed at Lhasa in 1940 at the age of about seven; a regent and a high council of ministers were appointed to rule during his minority.

When Chinese Communist forces invaded Tibet in November, 1950, the youthful Dalai Lama was hastily enthroned and then conducted to a refuge in the south. Six months later Tibetan delegates signed in Peiping the pact by which their country, although retaining a certain degree of self-government, became a virtual province of Red China.

See also EVEREST, MOUNT; HIMALAYA; LAMAISM; LHASA.

TIC, any abrupt, habitual movement involving a particular group of muscles. Such habits as blinking the eyes, shaking the head, grimacing, jerking the shoulders and other parts of the body, clearing the throat, and coughing are all classified as tics. In most instances, they result from nervous disorders or simply indicate the formation of a bad habit; only rarely are they due to organic disease. Tics commonly occur in children between the ages of five and twelve. Though some become progressively worse, many kinds of tics disappear as the child grows older. Mild tics usually do not require medical treatment, but in severe cases psychiatric treatment may be needed.

Tic douloureux, also called *trigeminal neuralgia,* is an entirely different disturbance. Of unknown origin and causes, this disease is characterized by intense, shooting pains in some part of the face. As the disease progresses, these painful attacks occur more frequently and last longer. Sometimes they are brought on by washing the face, laughing, drinking, eating, or exposure to cold. Temporary relief can be obtained with certain drugs, but permanent cure may require surgery.

U.S.D.A., Bureau of Entomology and Plant Quarantine

THE HEAD OF A DOG TICK, greatly enlarged, is shown at bottom. At the top is a dog tick swollen with blood after feeding.

TICK, a blood-sucking parasite that infests man, mammals, birds, and reptiles. Several hundred species exist in various parts of the world. Although they look like insects, they are actually related to mites, spiders, and scorpions and belong to the class Arachnida. Unlike insects, the adult tick has four pairs of legs and its body is an undivided whole, lacking a distinct head, thorax, and abdomen. Its mouth parts, which are adapted for sucking blood, are equipped with backward-curved teeth. When a tick bites a victim, its teeth are anchored firmly in the host's skin, and removing the tick is a difficult task. After gorging itself, the swollen-bodied tick then loosens its hold and drops off the victim. Female ticks, which may reach half an inch or more in length when fully gorged, are considerably larger than males.

The eggs of the female tick are laid on the ground among leaves and grass. Each egg hatches into a six-legged larva, which in time molts (sheds its skin) and becomes an eight-legged nymph. The nymph also molts, and the adult tick finally emerges. In some species, almost the entire life cycle is spent on the same host. In others, the developing tick must seek a new host after every molt. Full-grown ticks are sometimes able to survive for years without feeding, and the larvae have been known to live months without food.

While biting, ticks introduce venom into their victims, causing the skin to become red and swollen. The bites of certain species may affect the victim's nervous system and result in paralysis. Ticks are easily removed by applying oil or kerosene to their bodies; such substances interfere with their breathing and cause them to lose their grasp on the host. In addition to the skin irritation they cause, ticks may also carry disease organisms. Various species are known to transmit the organisms causing Rocky Mountain spotted fever, tularemia, Q fever, relapsing fever, and sleeping sickness in human beings and cattle tick fever, bovine anaplasmosis, canine and equine piroplasmosis, fowl spirochetosis, heartwater fever, and spinose ear infection in domesticated animals. See also Diseases of Animals.

TICKSEED. See Coreopsis.

TICONDEROGA, *ty kon dur o'guh,* Battles of. In early days the town of Ticonderoga, N. Y., which is situated between the northern end of Lake George and the western shore of Lake Champlain, occupied a strategic position across the path of armies coming down from the north toward the Hudson River Valley. In the eighteenth century it was the scene of several battles. The French built a fort near the village in 1755 and named it Fort Carillon. In 1758 it was held by a garrison of about 3,500 men under Montcalm. A British army of some

15,000 men, commanded by General Abercrombie (or Abercromby), attempted to storm the fort, but the defenders inflicted such heavy losses on the British that they retreated. Another force, commanded by Amherst, besieged Fort Carillon in 1759 and drove out the French. The victors renamed the fort Ticonderoga. In the Revolutionary War the old fort was held by a few British soldiers. A small force of Green Mountain Boys led by Ethan Allen and Benedict Arnold took the British by surprise early one morning in the spring of 1775 and captured the fort without meeting any resistance (see GREEN MOUNTAIN BOYS). The artillery taken at Ticonderoga was transported to Boston to strengthen Washington's army. Two years later, in 1777, General Burgoyne, advancing from the north, forced the Americans to abandon Fort Ticonderoga. Ruins of the old fort are still standing on a privately owned site near the town. Modern Ticonderoga, which has a population of about 3,500, is a resort center. The principal industries are papermaking and the manufacture of pencils from graphite mined in the neighborhood.

TI′DAL WAVE, more properly SEISMIC SEA WAVE, a wave that has no relation to tide-raising forces but is set in motion by a submarine earthquake in which a vertical displacement occurs. These waves are also called *tsunami,* the Japanese word for them. In the open sea, tsunami are too low to be noticed from ships and airplanes, but as they approach a coast there is an increase in height that depends upon the shape of the shore and the slope of the seabed. On a gently sloping shore the crest of the wave travels faster than the bottom, and the breaking of this onrushing wall of water adds much to the destructive force of the wave.

A tsunami on the Sanriku coast of Japan in June, 1896, killed more than 27,000 people and swept away many villages. The greatest height of this wave was 75 to 100 feet, and a wave more than 200 feet high was recorded in 1737; but most tidal waves are much lower. They move only a few miles per hour (*mph*) in shallow water, but they have an average speed of about 200 mph in the open Atlantic and 450 mph in the Pacific. The distance between crests may be as much as a few hundred miles. Often a marked withdrawal of the sea appears to be the first warning of the coming of a tidal wave; but tide-gauge records seem to indicate that a small rise in water level occurs first.

On April 1, 1946, an earthquake south of Unimak Island, Alaska, set up a tsunami that struck the Hawaiian Islands without warning about four and one-half hours later, after traveling more than 2,200 miles. At Honolulu an 8-inch rise and then a 2-foot fall in water level were followed by oscillations in which the level changed 3 or 4 feet. Elsewhere the wave was from 5 to 55 feet high and caused damage estimated at $25,000,000. This same wave produced 5-foot changes in water level when it reached Valparaiso, Chile. A warning system for the Pacific area was set up in 1949 by the Coast and Geodetic Survey. It is based upon reports of earthquakes in the area and of observations at many tide-gauge stations.

In popular usage the term tidal wave is also applied to any destructive rush of water on a coast, such as the wave from the exploding volcanic island Krakatau that hit the Java and Sumatra coasts in 1883. Water may also be piled to great heights, especially at high tide, by strong, steady winds, as happened on the coasts of Long Island and New England during the hurricane of September, 1938.

TIDES, the periodic rise and fall of the level of oceans and other large bodies of water caused by the gravitational attraction of the moon and sun. During *flood* tide the water level rises; during *ebb* tide it falls. The greatest height reached by each flood tide is called *high water,* or high tide, and the lowest level of ebb tide is *low water,* or low tide. In coastal waters, inlets, and harbors the variations in depth of water caused by tides and associated currents are of great practical importance to mariners; to those working around water, such as fishermen; and to others who do not want to run their boats aground. To serve their needs the United States Coast and Geodetic Survey publishes annual *Tide Tables,* which give daily tide predictions for more than 100 ports and other data from which may be estimated the depth of water at any time at these and many other ports. Similar tables are published by other maritime nations. See GRAVITATION.

Causes of Tides. If the ocean completely covered the earth the gravitational attraction of the moon for the water on the part of the earth nearest to it would be greater than for the earth as a whole and hence would pull the water up toward the moon (Fig. 1). The earth as a whole would also be attracted more than the water farthest from the moon. The result would be high water produced simultaneously at opposite sides of the earth,

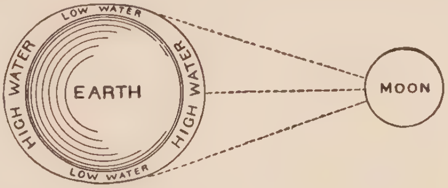


Fig. 1

in line with the moon, and low water at surface locations midway between these two. The eastward rotation of the earth on its axis would cause these two sets of high and low tides to move westward around the earth, always keeping the same relation to the moon and constituting a semidiurnal tide wave.

On the actual earth the tides are very complex because of the distribution of land and water and the shapes and depths of the basins in which the coastal waters lie. The sun is so much farther from the earth than the moon is that, even though it has a vastly greater mass than the moon, its tide-raising force is less than half that of the moon. Many tidal phenomena become clear if one thinks of solar tides being combined with lunar ones.

Tidal Period. The tide is usually *semidiurnal;* that is, there is a tidal cycle each half day and therefore two high and two low tides each day. On any particular day the tides occur, on the average, about 51 minutes later than on the day before. The mean (average) interval between the high water of one morning and the next is therefore 24 hours 51 minutes. This interval is also the average length of the lunar day, the period between one passage and the next of the moon across the meridian.

For many ports the *Tide Tables* give the *high water interval* (also called the *establishment of the port*), which is the average interval of time between an upper or a lower transit of the moon across the meridian and the time of high water. (Upper and lower transits of the sun, for example, occur at noon and midnight, respectively.) Two places not very far apart may have quite different high water intervals. Though any particular high water may occur as much as half an hour earlier or later than the time estimated from this interval, it is still a useful bit of information for collectors of shells, as well as for navigators.

At some places there is a *diurnal* tide, that is, only one high and one low water a day. At Pensacola, Fla., for example, the tide is ordinarily diurnal, becoming semidiurnal only for a day or so each month when the moon is on or near the celestial equator. At Galveston, Tex., and Colón, Panama, the tide is normally semidiurnal but becomes diurnal for a number of days each month.

Range of Tides. The difference in level between high and low water, or *range* of the tide, at islands in the open ocean is on the average about 2.5 feet. In large lakes the range is a few inches at most, less than changes of level caused by winds. Great extremes of range occur on continental coasts. At the Atlantic end of the Panama Canal the mean range of the tide is less than a foot, but at the Pacific end it is about 12.5 feet. The tidal range is often great in inlets and straits; in the Bay of Fundy it is sometimes 50 feet or more. In some rivers, notably the Severn, the Amazon, and the Fuchun (Tsien Tang) of China, the upstream rush of the tidal current forms a tidal *bore,* a wall of water several feet high. The bore is as dangerous to boats as it is noisy.

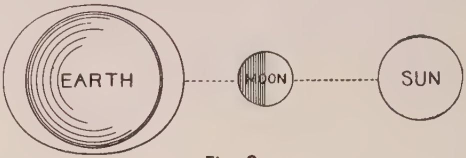


Fig. 2

At new moon (Fig. 2) and full moon, when earth, moon, and sun are in a straight line, the high tides due to the sun are added to those due to the moon. High water is higher everywhere than average, and low water is lower. These tides, which are greater than average in range, are called *spring* tides. A week later, at the first and third quarter of the moon, the moon as seen from the earth is 90° from the sun (Fig. 3), and low tides due to the sun are added to the high tides due to the moon. In these tides, called *neap* tides, high water is lower than average and low water is higher, making the range less than average.

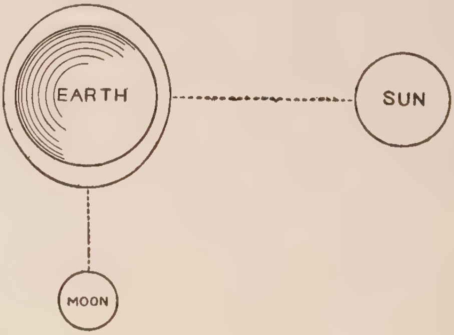


Fig. 3

When the moon is on the celestial equator there is usually not much difference in the heights of two successive high tides of a given day, or two low ones. But when the moon is farthest north or south each month there may be a marked difference in the heights of successive high (or low) tides. This difference, called the *diurnal inequality,* is much more noticeable in the tides of the North Pacific and the Gulf of Mexico than in those of the North Atlantic.

Even in the surface of the solid earth there are tides with a maximum range of about nine inches. These tides can be determined by delicate measurements of very small changes in the tilt of the surface, or by Michelson's indirect method, in which tides of less than 0.001 inch are measured in the water which half fills long pipes.

Tide Prediction. Tide-gauge data for a year or more at any place are analyzed to find the contribution made to the observed tide by each one of many (20, 30, or more) minor tides. To illustrate, the rotation of the earth gives two such components with periods of the lunar day and the solar day; the moon's orbital motion about the earth gives one component due to its changing distance and another arising from its north-south motion, both with a period of a lunar month; and the earth's orbital motion about the sun gives two similar components with an annual period. The time relations among the various components differ greatly from year to year, but they are easily combined mechanically by a tide-predicting machine which gives the predicted tides in the form of a long graph. A separate analysis and graph is made for each station included in the tables.

Tidal Friction. Especially in the shallower coastal regions, some of the rotational energy of the earth is being transformed into heat through friction between the sea bottom and the incoming and outgoing tidal waters and also through fluid friction in the tides. As a result the earth's rotation is becoming slower and the day is gradually increasing in length (see DAY; TIME, MEASUREMENT OF). It is estimated that it takes a century for this cause to increase the length of the day by one thousandth of a second. In the billions of years that the earth-moon system has existed, the cumulative effect of this small change has had important effects on the separation and rotation periods of the two bodies.

Tidal Power has been used in the past to operate small mills along the tidewaters of New England. Plans for large-scale utilization of tidal power have been made for several places, but they have not been carried out because of doubts that the enormous costs of the projects would be justified.

TIENTSIN, *tin'tsin'*, CHINA, is a large seaport and an important commercial city about eighty miles southeast of Peiping, on the Hai River, which empties into a gulf of the Yellow Sea. It is at the northern end of the Grand Canal, and it is also served by railroads and river waterways. Tientsin is the port for Peiping and the shipping center for much of the wheat and wool raised in North China. Flour and cotton mills are numerous. Tientsin was opened to foreign commerce in 1860, after a treaty had been negotiated by Lord Elgin, and until World War II a section of the city was reserved for the international settlements, or concessions. In 1900 Tientsin was the scene of disorders during the Boxer Rebellion, and allied foreign troops started for Peiping from the port (see BOXER REBELLION). The Japanese occupied the city from 1937 until 1945; it was seized by Chinese Communist forces in 1949. The population is about 2,694,000.

TIERRA DEL FUEGO, *tih ehr'uh del foo-a'goh,* the group of islands forming the southern tip of South America, south and east of the Strait of Magellan, is divided between Chile and Argentina. The western half of the main island, which is also called Tierra del Fuego, and the islands to the west and south are part of the territory of Magallanes in Chile. The eastern part and a few islands to the east comprise the territory of Tierra del Fuego in Argentina; Ushuaia, capital of the Argentine section, has a population of about 1,500. The Andes range runs across the Chilean islands and the southern part of the principal island. Throughout most of the archipelago snow-covered mountains rise abruptly from the sea, reaching a height of nearly 8,000 feet. High winds and frequent storms make navigation in the rock-strewn channels between the islands very dangerous. The western mountain slopes, exposed to the prevailing westerly winds, receive heavy rain and snow, and glaciers reaching to the seacoast give rise to icebergs. Cape Horn, the southern promontory of Horn Island and the southernmost point of the archipelago, is about 400 miles from the Antarctic Continent. Tierra del Fuego has few inhabitants. The chief occupations are sheep raising and hunting otter and seal. Not many of the native Indian people, called Fuegians, remain.

TIF'LIS, or **TBILISI**, *t'pih'lih sih,* SOVIET UNION, the capital of the Georgian Soviet Socialist Republic, is situated in the Transcaucasian region midway between the Black and Caspian seas. The city, whose name means *warm springs,* is picturesquely located in the Kura River valley, with mountains enclosing it on all sides. It is a railway center and an important industrial city with varied manufactures. Its many educational and cultural institutions include a large university. Tiflis is said to have been founded in A.D. 379; during the next century it became the capital of the kingdom of Georgia. It has been captured by many invading armies, but since 1799 it has been under Russian rule. The old city, which is built around the hot sulfur springs for which it is named, is still Oriental in appearance. The modern city is European in plan, with broad boulevards and fine buildings. Population, about 520,000.

TI'GER, one of the largest, most powerful members of the cat family. Throughout the centuries the tiger has been well known for its striking beauty and terrifying savagery, its lithe grace and tremendous power. An inhabitant of Asia, it is found from

American Museum of Natural History, New York

USUALLY IDENTIFIED WITH THE STEAMING JUNGLE, the tiger is also found in the snowy forests of Siberia, where it grows a heavy winter coat.

southern Siberia through China down to the Malay Peninsula, Java, Bali, and Sumatra; its range extends westward through India and Iran as far as the Caucasus Mountains. In each of the scattered areas in which it occurs, the tiger varies slightly in size, coloring, or length of coat, and therefore separate subspecies are recognized.

Though it lacks a mane and appears more slender, the tiger equals if not exceeds the lion in size, strength, and physical beauty. A very large male tiger stands about three and one-half feet high, reaches a length of eleven feet from nose to tip of tail, and weighs more than five hundred pounds. Females are somewhat smaller than males. The sleek coat of the tiger is colored a bright tawny yellow, attractively marked with irregular black stripes. The three-foot tail is ringed with black, while the underparts of the body and part of the face are almost white. This coloration blends readily with the jungle vegetation, providing some protection for the tiger as it stalks silently about its gloomy domain.

Habits. Tigers prefer dense bamboo and grass jungles and often frequent overgrown river banks. They remain in their lairs during the day, emerging at night to stalk prey. Like lions, they are carnivores (meat eaters) and attack deer, antelope, wild pigs, and even domesticated animals. Sometimes they lie in wait at water holes to ambush the animals that come to drink. After the prey has been killed, its carcass is dragged into the bushes where the tiger feasts until full. Thereafter the tiger returns each night until the body is consumed. Tigers, especially the females, occasionally become man-eaters and every year are responsible for many deaths in India.

Two to six tiger cubs are born about every two years, though there is no definite breeding season. The cubs remain with their solicitous mother until they are two years old, but as adults they usually travel alone. In captivity tigers have been successfully bred to lions. The offspring of a male lion and female tiger is called a *liger;* that of a male tiger and female lion is a *tigon.* Tigers mature at three years of age.

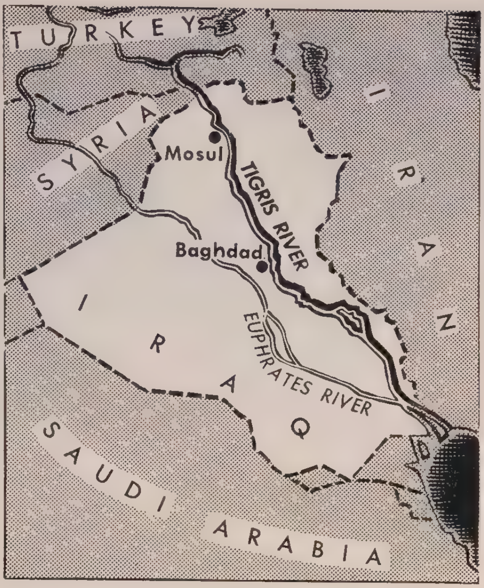
Tiger Hunting. The most expensive hunts are those in which the hunters ride in *howdahs,* or cages, upon the backs of elephants. Native beaters set out on foot to "beat the bush" by making enough noise to drive the tiger from its lair and into the open. The object is to head the tigers in the direction of the elephant, from which the hunter is able to shoot. In another popular method of hunting tigers, the hunter sets himself up in the fork of a tree overlooking a water hole. Sometimes a live goat is tethered nearby to attract the tiger. When the tiger comes into view, the hunter has a vantage point from which to shoot. Tiger skins make handsome rugs. Zoo specimens may be trapped alive in deep pits covered with grass and foliage and sold for $2,000 or more. In captivity, their life span may reach twenty-five years, though wild tigers probably die much sooner. See also Lion.

Scientific Name. *Felis tigris.*

TIGER LILY, a showy lily native to China and Japan and widely grown in North America, where in many places it has become naturalized. Its stems, two to six feet tall, bear numerous slender, pointed, alternate leaves and are topped by several funnel-shaped, orange-red, purple-flecked flowers with backward-curling petals. The tiger lily is hardy and is easily grown almost everywhere in the United States. It may be propagated by seed, by scales from its bulbs, or by means of the bulblets that develop in the axils of its leaves. See also Lily.

TI′GRIS RIVER, an important river of Iraq, is famous in ancient history because Mesopotamia, the region between the Tigris on the east and the Euphrates on the west, was the cradle of some of the earliest great civilizations of the world. The Tigris rises in the mountains of Turkish Kurdistan, not far from the source of the Euphrates, and flows generally southeastward for about eleven hundred miles. Near Mosul, in the north, it passes the ruins of Nineveh, ancient capital of Assyria. Below Baghdad, on opposite sides of the river, were Ctesiphon, the capital of Parthia, and Seleucia, one of the great cities of the Seleucid Empire. Above the modern city of Basra, the Tigris joins the Euphrates to form the Shatt-al-Arab, which empties into the Persian Gulf about seventy-five miles to the southeast.

The Tigris is shorter than the Euphrates, but its volume is greater and its current swifter. Its chief tributaries enter it from the east. The river is navigable for steamers as far as Baghdad, more than two hundred miles from Basra. The waters of the Tigris and the Euphrates have been used since prehistoric times to irrigate the level fields of fertile land along their banks. See also Euphrates River; Mesopotamia.



ANCIENT CIVILIZATIONS developed in the region watered by the mighty Tigris.

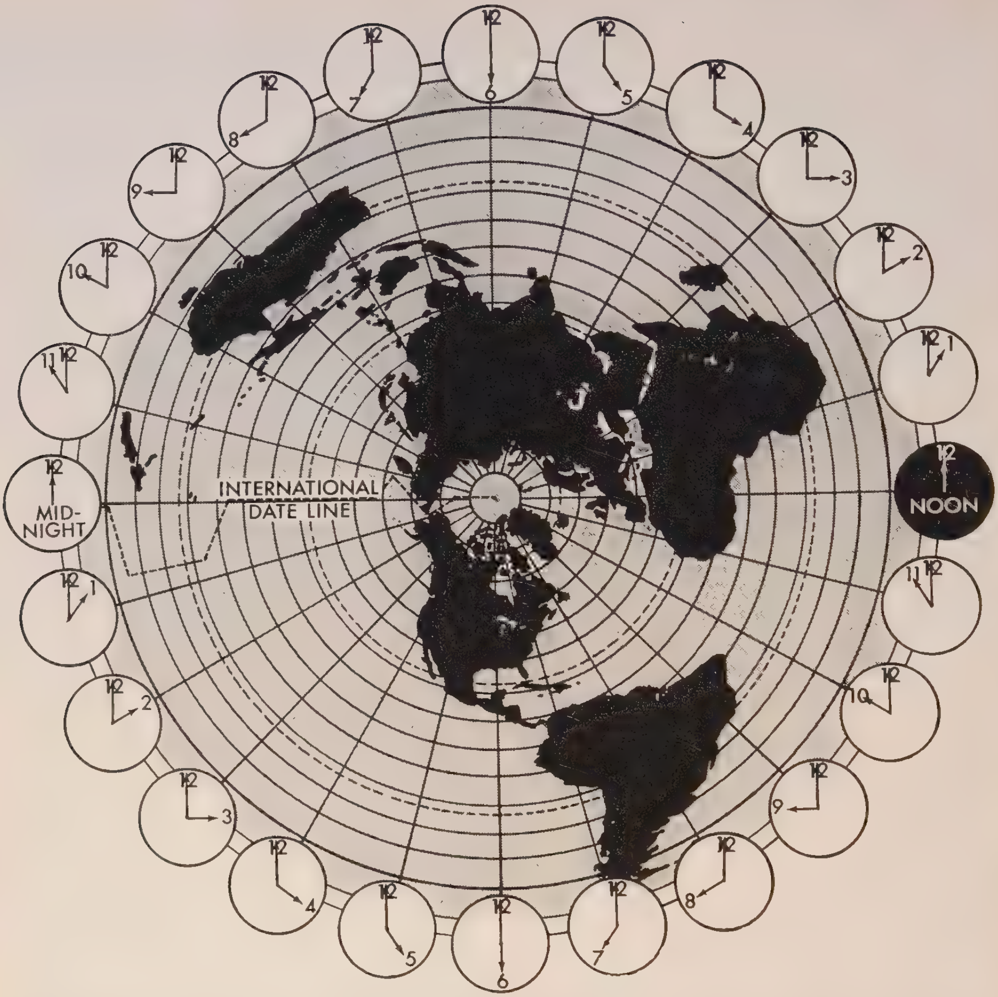
TILDEN, William T. See Tennis.

TILE, a slab of baked clay used in covering roofs, paving floors, decorating walls, and carrying off drainage. The process used in making tile is generally similar to that used in brick making; and, like brick, tile has been made since very ancient times. Drainage tile may be in the form of a pipe or tube, or it may be semicircular in cross section. Roof tile may be either curved or flat, and, like drain tile, it is usually made to connect by interlocking or overlapping. Floor and wall tiling is flat, and the square, oblong, or many-sided pieces, often in contrasting colors, may be laid in attractive designs. Floor tiles in which the body of the tile is in one color and the pattern upon it is in other colors are known commercially as *encaustic* tiles. Glazing gives wall tile a smooth, shiny surface. Fine clay tiling is frequently used on the walls and floors of bathrooms. In other rooms rubber and asphalt tile is often used for flooring, and enameled metal or linoleum tile, or sheets of linoleum designed to have the appearance of tiling, are popular kitchen-wall coverings. See also Brick and Bricklaying.

TILE′FISH, an edible deep-sea fish of the Atlantic Ocean. Tilefish were discovered accidentally in 1879 by fishermen trawling for cod in the warm currents near Nantucket, and for the next few years they were taken in increasingly large catches. In 1882 they suddenly began to die off, apparently as a result of an inflow of cold-water currents. For ten years they were thought to be extinct, but in 1892 they reappeared. Since then their numbers have gradually increased to a point where they now support a small fishery yielding about 40,000 pounds a year. Though their flesh is flavorable, they have never become a widely known food fish. The brilliantly colored tilefish may weigh from ten to fifty pounds and has an unusually large, blunt-snouted head, the top of which bears a fleshy protuberance. See also Fish.

Scientific Name. *Lopholatilus chamaeleonticeps.*

TIL′LY, Johann Tserclaes, Count of (1559-1632), a professional soldier who was the leader of the Catholic forces during the first part of the Thirty Years' War, was born in Flanders. His first military experience was with the Spanish army, but he eventually entered the service of Austria, rising to the



TIME ZONES, CIRCLING THE GLOBE, divide the world into twenty-four segments, the number of hours in a day. The clocks indicate the standard time in each segment when the master clock in Greenwich, England, at longitude 0°, stands at 12 o'clock noon.

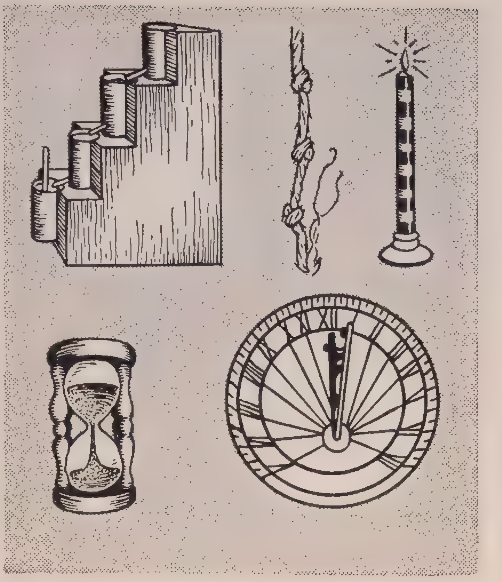
rank of general and then field marshal. In 1610 he was selected by Maximilian of Bavaria to reorganize his army, and after the outbreak of the Thirty Years' War in 1618, Tilly distinguished himself by winning many victories. He was made a count in 1622. Sweden came into the war in support of the Protestants in 1630, and Tilly was given the command of the combined armies of Austria and Bavaria. These troops stormed Magdeburg in 1631 and sacked the city, but this was Tilly's last victory. A few months later the Swedish king, Gustavus II Adolphus, defeated him at Breitenfeld, near Leipzig, and in a second battle early in 1632 Tilly received a mortal wound. See also THIRTY YEARS' WAR.

TIME, MEASUREMENT OF. Early people were well aware that the sun rose and set at more or less regular intervals, that the seasons followed a fixed pattern, and that man went through a cycle of childhood, adolescence, maturity, and old age. They did not mark many divisions of time, or mark them accurately. They undoubtedly used the sun's position in the sky to tell the time of day, just as modern man often does. Sunrise, sunset, and noon, the time when the sun is halfway between the eastern horizon and the western, were probably the most important points of time. Time in the past could be reckoned as "three suns past," "the winter of the great snow," or "when the river flooded the farthest part of the land." In other words, people experienced time, but they did not make an abstract idea of it as something that goes on continuously and always at the same rate. But before recorded history many peoples were seeking ways to measure time.

The modern idea of time is that it is a kind of dimension and that time and space are closely related. Distances are often expressed in units of time. The dealer in real estate, for instance, says that the house is ten minutes from the station; the astronomer says that the Andromeda Nebula is about 800,000 light-years from the earth, that is, the distance light travels in 800,000 years; if two people are to meet, they must fix a time as well as a place for the meeting.

Units of Time. In the measurement of time there are two fundamental units: the day, which is based on the rotation of the earth, and the year, which is the period of the earth's revolution around the sun. The day is the basis of clock time; the year, the basis of calendar time.

The month and the week are associated with the motion of the moon around the earth, but they are not measured by observation of the moon. A week is a period of seven days, and a month is a period varying between 28 and 31 days. Hours, minutes, and seconds are just arbitrary subdivisions of a day: an hour is one twenty-fourth of a day, a minute is one sixtieth of an hour, and a second is one sixtieth of a minute. Any other numbers might have been used as divisors, and any other names might have been given to these fractions of a day; but these particular combinations work out quite well and are widely used throughout the world. The precise measurement of time is a part of modern living. Plane and train schedules, athletic events, and radio and television programs are carefully timed. School days and workdays are limited by the clock, and in many cases pay rates are in terms of dollars per hour. The scientist in his laboratory and the navigator at sea need exact measurements of time in making their calculations; and the housewife, in her cooking and baking, must keep a careful eye on her clock. Scientists use special divisions of time, ranging from microseconds, or millionths of a second, in nuclear physics to units of millions of years in geology and astronomy.

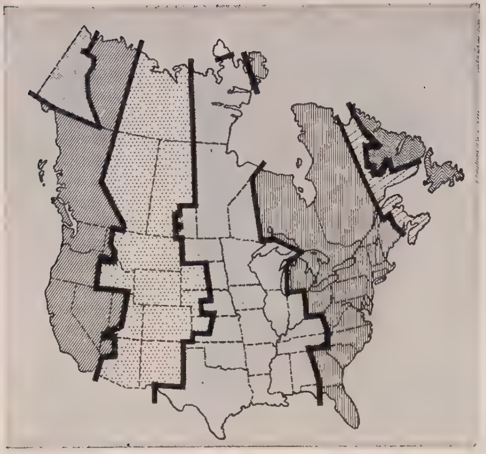


TIME-TELLING DEVICES of ancient times included the Chinese water clock (top left), the fire clock of knotted rope (top center), the candle clock (top right), the hourglass (bottom left), and the sundial (bottom right).

The Day. The rotation of the earth can be measured by observing the *apparent* motions of the sun and the stars, for it is the earth's eastward spin on its axis that makes the sun and the stars appear to cross the sky each day or night from east to west. The dome of the sky is divided in half by the meridian, an imaginary circle passing through the poles of the heavens and the zenith, or overhead point, of the observer. The transit of a star across the meridian can be observed and the time noted. When the same star next comes back to the meridian, the earth will have completed one rotation with respect to the stars; this interval is a *sidereal* day.

The stars are so far away that the movement of the earth in its orbit around the sun does not affect the length of the sidereal day, which is approximately 23 hours, 56 minutes, and 4 seconds; but this motion does make a difference in the length of the *solar* day, which is the time it takes the earth to make one rotation with respect to the sun. It makes the sun appear to move eastward among the stars, a little each day. While the earth is making a sidereal rotation, the sun is apparently moving about one degree to the east; in order to catch up with it, the earth must keep turning a little longer. If this apparent eastward drift of the sun were always the same, the solar day, like the sidereal day, would be of uniform length throughout the year. However, the earth does not travel in its orbit at a uniform rate of speed, and its axis is tilted at an angle to the plane of its orbit. Because of these two factors, the sun seems to go faster at one time than at another, and sometimes the direction of its motion is more toward the north or the south than to the east. Therefore the interval between successive transits of the sun's center across the meridian is not always the same.

For practical purposes a day must be a fixed length of time, and therefore a *mean* sun, one that would cross the meridian at equal intervals, was invented. The length of the ordinary day (the *mean solar* day) is the



THE TIME ZONES of the United States, from east to west, establish Eastern Time, Central Time, Mountain Time, and Pacific Time. Canada's divisions are Newfoundland Time, Eastern Time, Central Time, Mountain Time, Pacific Time, and, in the northwest, Yukon Time.

interval between successive transits of this imaginary sun. When this mean sun crosses a meridian, the *local mean time* of all places lying along the meridian is noon. For a long time each town set its clocks by local mean time, but this meant that only those clocks along the same meridian would show the same hour. Every degree of longitude east or west of the meridian means a difference of four minutes in local mean time; thus fifteen degrees of longitude means a difference of one hour of time, and the circumference of the earth, a circle of 360°, spans the full twenty-four hours of the day.

Standard Time. In 1883 a standard time system was adopted in the United States. Under this arrangement four zones of time were marked off, their boundary lines running irregularly from north to south across the continent, and the local mean time of the zone's central meridian was established as the *standard time* for the zone. The central meridian of each zone is 15°, or one hour, from that of the next zone. A traveler starting west from Boston or New York leaves on Eastern Standard Time; at Toledo or Cincinnati he sets his watch back one hour to Central Standard Time; in western Nebraska or Kansas he sets it back another hour to Mountain Standard Time; and west of Salt Lake City he changes to Pacific Standard Time. A world system of similar time zones, beginning with the prime meridian that passes through Greenwich, England (0° of longitude), was adopted in 1884.

The *civil* day begins and ends at midnight. In many countries it is divided into two periods of twelve hours each. The hours between midnight and noon are marked *a.m.* (*ante meridiem,* or before noon), and those between noon and midnight are marked *p.m.* (*post meridiem,* or after noon). In a number of countries and in many special circumstances the hours are numbered from 0 to 23, so as to avoid any confusion between morning and afternoon times.

In some communities clocks are set ahead one hour at the beginning of the summer months, so that people can take advantage of an extra hour of daylight at the end of the day. In England this is called *summer* time or, if the clocks are set ahead two hours, *double summer* time. In the United States it is called *daylight-saving* time. At the end of September the clocks are set back to standard time.

For many purposes accurate timekeeping is very important. The transit of a star is easier to observe than the transit of the sun's center; and since the relationship of the sidereal day to the mean solar day has been worked out exactly, astronomers use the observed transit of a star as the basis for calculating the correct mean solar time. In the United States radio signals giving the correct time are broadcast each day from the United States Naval Observatory at Washington, the nation's capital.

Related Articles. For further information, consult the following titles:

Calendar
Clocks and Watches
Day
Daylight Saving
Earth
Epoch
Hour
Hourglass
International Date Line
Longitude
Meridian
Month
Sundial
Week
Year

TIME, STANDARD. See DAY; DAYLIGHT SAVING; TIME, MEASUREMENT OF, *Standard Time.*

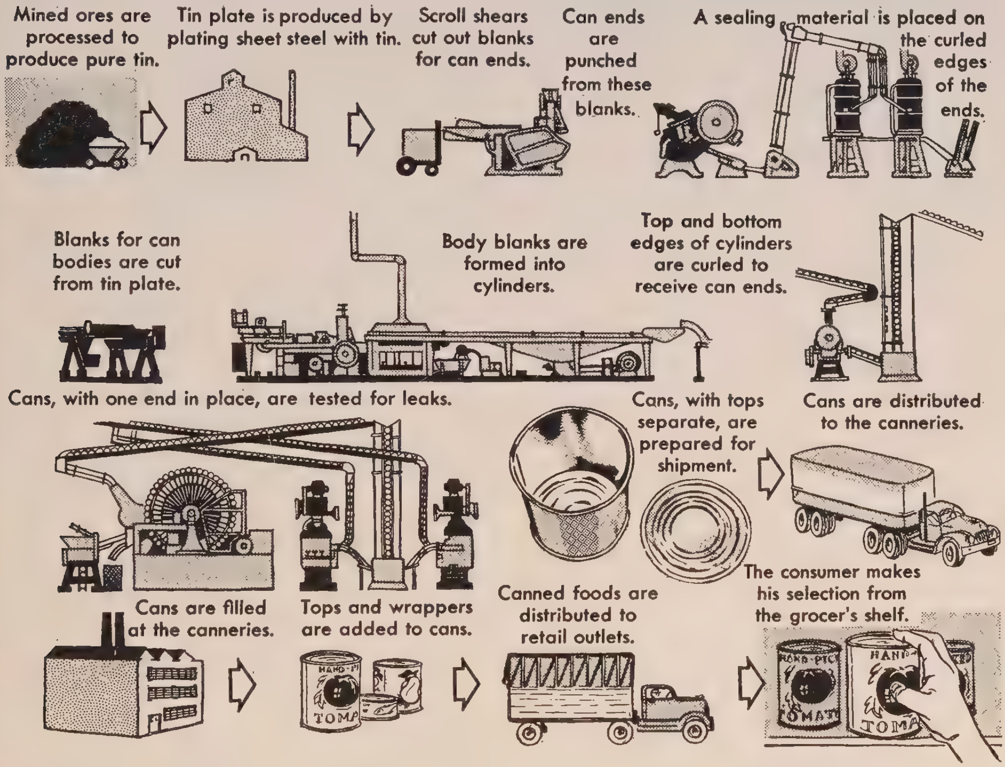
TIM'OTHY, a disciple and associate of the apostle Paul, was the son of a Jewish mother and a Greek father. Called by Paul his "dearly beloved son," he was one of the Apostle's most dependable helpers. Apparently he was with Paul in Rome when the latter wrote some of his letters from prison. According to tradition Timothy became bishop at Ephesus and was martyred there about the year 100. The First and Second Epistles to Timothy—which, with the Epistle to Titus, are called the Pastoral Epistles because they deal with church affairs — were written by Paul to Timothy at Ephesus. The first letter instructs Timothy on church worship and leadership and warns him against false teachers; the second, in which the Apostle foretells his imminent execution by Nero, urges his disciple to continue the work with unwavering faith and courage. See also PAUL, SAINT.

TIMOTHY, or **HERD'S GRASS,** a hardy perennial grass native to Europe. It grows in clumps, twenty to forty inches tall. Its long, flat leaves and slender, erect stems grow from bulbous bases and are topped by cylindrical flower heads. The Southern states are too hot and the Great Plains too arid for its cultivation. In the northeastern quarter of the United States, however, it predominates over all other grasses, for it is easily grown, it yields well, and it is palatable to animals. Predominantly a hay grass, it is commonly grown with red clover. John Herd is believed to have found it growing wild in New Hampshire about 1700 and to have begun cultivating it. It is named after Timothy Hansen, who is said to have introduced it into Maryland about 1720.

TIM′ROD, Henry (1828-1867), a talented lyric poet and spokesman for the South, was born in Charleston, S. C. The poems he wrote just before and during the War between the States were so impassioned and sincere that he came to be considered one of the chief voices of the Confederacy. He was always poor, and he failed in health after Federal troops burned the city of Columbia, where he was acting as an editor of the *South Carolinian*. His poems were collected and published in 1873, after his death, and a memorial edition appeared in 1899.

TIMUR, *tih moor′*. See Tamerlane.

TIN, a silvery-white or gray metallic element known since ancient times, plays an important role in modern civilization. In the Western world a large part of the food supply is preserved in so-called tin cans. Actually, these containers are made of sheet steel or iron covered with an extremely thin coating of tin, which is highly resistant to corrosion by air and by the acids in fruits and vegetable juices. Despite its wide use, tin is a fairly expensive metal, costing considerably more than aluminum, copper, lead, nickel, and iron.


Mined ores are processed to produce pure tin.
Tin plate is produced by plating sheet steel with tin.
Scroll shears cut out blanks for can ends.
Can ends are punched from these blanks.
A sealing material is placed on the curled edges of the ends.
Blanks for can bodies are cut from tin plate.
Body blanks are formed into cylinders.
Top and bottom edges of cylinders are curled to receive can ends.
Cans, with one end in place, are tested for leaks.
Cans, with tops separate, are prepared for shipment.
Cans are distributed to the canneries.
Cans are filled at the canneries.
Tops and wrappers are added to cans.
Canned foods are distributed to retail outlets.
The consumer makes his selection from the grocer's shelf.
HAND-PICKED
TOMA

BEGINNING AT THE MINE, ENDING IN THE PANTRY, the story of the familiar tin can is a marvel of modern industrial science. Manufacturing lines produce hundreds of cans per minute.

Sources of Tin. Very little free tin is found in nature. The only commercial ore of tin is *cassiterite*, or tin stone, a compound of tin with oxygen; and cassiterite occurs in sufficient quantity to be of commercial value in only a few places. The Malayan Federation, Indonesia, and Bolivia furnish most of the world's tin ore, replacing the once great source in Cornwall, England. The United States, the world's largest consumer of tin, produces practically none of the metal itself.

Tin ores are usually found mixed with compounds of other metals. The ores are crushed, washed, and then roasted to vaporize the sulfur and arsenic and convert the metallic

Art Institute of Chicago

VENUS AND MARS WITH THE THREE GRACES (detail) is a striking example of the romantic art of the great Italian painter, Tintoretto.

elements to oxides. The tin oxide is separated from the other metallic oxides by dissolving out the latter in dilute hydrochloric or sulfuric acid. The tin oxide is then heated in a furnace with carbon. The carbon combines with the oxygen of the tin oxide, forming carbon monoxide, which escapes as a gas. The molten tin collected on the bottom of the furnace is drawn off and allowed to harden. Melted once more, it flows away from solid impurities and is finally cast into blocks.

The United States, which did not begin smelting tin until 1940, after war conditions had cut off access to Oriental and English smelters, is now the world leader in tin smelting. Other major smelters include the Malayan Federation and the United Kingdom.

Properties and Uses of Tin. As ordinarily used, tin is a silvery-white, crystalline metal. At ordinary temperatures it can be hammered into thin sheets called tin foil. When heated, tin becomes very brittle and can be ground to a powder. It changes to a gray powder when chilled to –50°C. Tin has a low melting point (231.9°C.) and a very high boiling point (2260°C.). The atomic weight of tin is 118.7; the atomic number is 50; and there are ten naturally occurring isotopes, or tin atoms of different weights (see ISOTOPES). It takes a high polish, which it retains at ordinary temperatures in the presence of air and moisture.

The largest single use for tin is in the manufacture of tin plate. In the older method, tin plate was produced by dipping thin sheets of iron or steel into molten tin. The newer method is an electrolytic process in which sheet steel is plated by being drawn through a tank containing a solution of a tin compound. Tin anodes supply the tin for plating, and the steel sheets form the cathode. A direct current of electricity passed through the solution causes tin to be deposited on the steel. The electrolytic process is much faster than the older hot-dip method and provides a much thinner coating, thereby saving tin.

Terneplate — steel coated with an alloy of 85 per cent lead and 15 per cent tin — is used for automobile fuel tanks, paint and oil cans, roofing, and rainspouts. Considerable quantities of tin are used in the production of alloys. Most important of these is solder; others are Babbitt metal, britannia metal, pewter, fusible alloys, bronzes, and type metals. Tin foil is used in wrapping candies, foods, and cigars.

Tin and Its Compounds. The chemical symbol for tin is Sn, derived from the Latin name *stannum.* Tin forms two series of compounds: stannous compounds, in which the metal has a valence of + 2, and stannic compounds, in which the metal has a valence of + 4. *Stannic oxide,* SnO_2, is a white solid used in the manufacturing of opaque glass and in the making of enamels for porcelain-lined sinks. *Stannous chloride,* $SnCl_2$, is a white, crystalline solid used for weighting silk, as a mordant in dyeing, and for tinning pins, paper clips, and other small objects. *Stannic chloride,* $SnCl_4$, is a colorless, fuming liquid used for weighting silk and as a mordant in dyeing silk. *Stannic sulfide,* SnS_2, is a shiny, yellow solid formed by heating a mixture of tin filings, sulfur, and ammonium chloride. Known as "mosaic gold," it is used in gilding and bronzing.

TINTORETTO, *tin toh ret'oh,* the popular name of JACOPO ROBUSTI (1518-1594), one of the last great painters of the Italian Renaissance. Both energetic and industrious, Tintoretto painted a tremendous number of religious pictures and mythological scenes, proving himself a master of dramatic movement, depth, and light and shade. The artist was a Venetian dyer's son, and his nickname, Tintoretto, means *little dyer.* He was very briefly Titian's pupil, but for the most part he taught himself. He worked so hard and produced such dramatic pictures that the Venetians called him "Thunderbolt." In highly original compositions Tintoretto expressed his ideas with powerful feeling. His best work is marked by splendid rhythmical design, to which both his dramatic lighting and his vigorous figures contribute. When he exercised restraint, he achieved rare poetic beauty. "Susanna and the Elders," in the Vienna State Collections, is one of the most delightful of his paintings. Tintoretto's "Paradise," which was painted when the artist was over seventy, is one of the largest pictures in the world. It occupies an entire wall in the Palace of the Doges in Venice, covering about 250 square yards and containing 500 figures. The lovely "Marriage of Bacchus and Ariadne" is also in the palace. "The Miracle of Saint Mark," in the Academy at Venice, is another fine work.

TIPPECANOE, *tip ee kuh noo'*, Battle of, fought November 7, 1811, on Tippecanoe River in present-day Tippecanoe County, Indiana. It was an engagement between the Indians and a force of Americans led by William Henry Harrison. Angered by the rapid advance of white settlers into the Indian lands, the great Shawnee chief Tecumseh and his brother, who was called the Prophet, organized a confederation of tribes to oppose the Americans. General Harrison, then governor of Indiana Territory, thereupon led an army of about 1,000 militiamen and regulars against the main Shawnee village on Tippecanoe River. Within a mile of his objective Harrison made camp, after arranging for a conference with the Prophet the next day; shortly before dawn, however, the Indians treacherously attacked the camp. They were driven back after a furious two-hour battle, in which the Americans lost about 190 in killed and wounded. Harrison closed his campaign with the destruction of the deserted Indian village. While the battle made Harrison a popular hero, the victory was not decisive; Tecumseh, who was absent during the battle, continued his crusade against the white settlers and during the War of 1812 fought as an ally of the British. See also Harrison, William Henry; Shawnee; Tecumseh; War of 1812.

TIRANA, *tee rah'nah,* capital of Albania. See Albania.

TIRE. See Pneumatic Tire.

TIROL, or **TYROL**, *tih rohl'*, a mountainous region in western Austria, between the Bavarian Alps on the north and the Ötztaler Alps on the Italian border to the south. The Vorarlberg on the west was joined to the Tirol in 1938, when the Tirol-Vorarlberg province was created. Innsbruck is the principal city of the Tirol. Most of the towns are small, picturesque villages in the mountain valleys. The people, who are mostly German-speaking, cling to their ancient traditions. Both men and women wear colorful provincial costumes. The Tirol is famous for winter sports, especially skiing, and it is also a favorite summer resort. Cattle graze on the mountain slopes in summer. See also Austria.

TISSUE, *tish'yoo,* in biology, is any group of cells having the same structure and performing the same special function. The bodies of man and the vertebrate animals are composed of five general kinds of tissues. These are grouped together into organs, and the organs in turn form systems. The microscopic study of tissues is called *histology*.

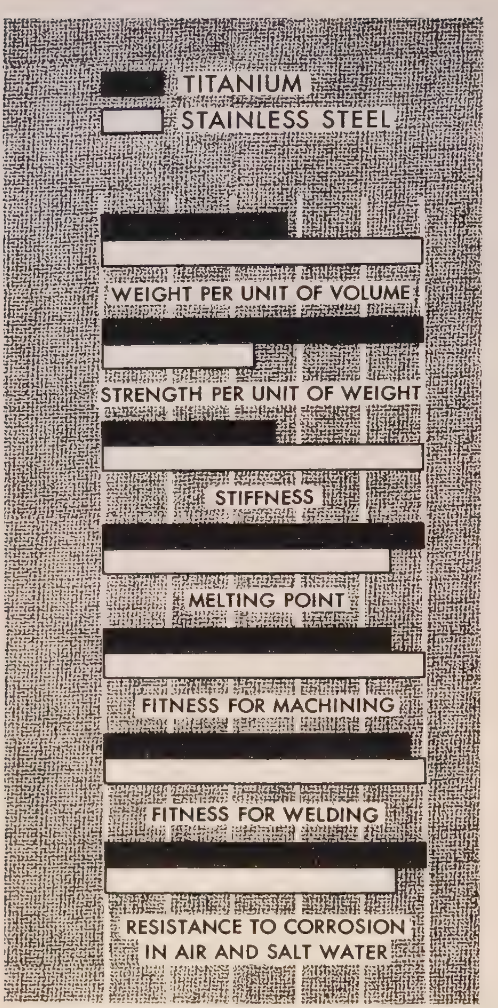
Epithelial tissues cover the skin and line the body cavity, digestive tract, respiratory tract, blood vessels, and other parts. They may be classified according to the shape of their cells as columnar (tall, column-shaped cells), squamous (flattened cells), or cuboidal (cubelike cells); and they may consist of a single layer or of several layers of cells. Some kinds of epithelial tissues simply provide protection for the organs, but others produce secretions or have sensory functions.

Muscle tissues are composed of long, fiberlike cells capable of contraction. They not only enable the whole body to move from place to place but also allow movement of the individual organs, such as beating of the heart and peristaltic contractions of the intestines. There are three types of muscle: striated, or skeletal, muscle for moving the bones; smooth muscle, found in the blood vessels and internal organs; and cardiac muscle, contained in the heart.

Nervous tissue contains nerve cells which have fine threadlike extensions; these extensions are bundled together to form nerves. Such tissue ensures the co-ordination of the body as a whole. The *vascular* tissues, including the blood and lymph, contain cells surrounded by fluid. They function mainly as a transport system, carrying food, oxygen, and waste products to the proper places in the body.

Connective tissues, so called because they function in supporting the body and in binding various parts together, are of many kinds. Adipose tissue is a type of connective tissue in which the cells store large amounts of fat. Fibrous connective tissue, such as is found in ligaments and tendons, consists of tough, white fibers arranged in bundles, with the cells lying between the bundles. Bone, in which the cells are surrounded by a hard framework of calcium salts, and cartilage, in which the cells are lodged in cavities in a tightly woven network of white fibers, are also connective tissues. Elastic connective tissue consists of stretchable yellow fibers and is present in the lungs and in the walls of the arteries. Areolar connective tissue, containing both white and yellow fibers, forms a protective covering about many organs. See also Blood; Lymph; Muscle; Nervous System; Tendons.

TITANIUM, *ty ta'nih um,* a lustrous, silvery-white, metallic element discovered in 1791, is one of the most abundant of the elements, constituting almost 1 per cent by weight of the earth's crust. Millions of tons of titanium minerals are present in the sands along the Florida and Oregon coasts; and there are huge deposits in Virginia, Wyoming, and Arkansas and in Canada, India, China, Norway, and the Soviet Union. Titanium is difficult to extract from its ores in pure form; but when it becomes available in large quantities at a reasonable cost, it promises to become one of the most useful of the structural metals and to serve a wide variety



COMPARED WITH STAINLESS STEEL, titanium has a number of superior qualities.

of uses for precision instruments and other consumer goods.

Titanium is a light metal which can be given a surface hardness approaching that of diamond. It has exceedingly high tensile strength and is highly resistant to corrosion caused by foods, air, and salt water (see TENACITY). It has a very high melting point, expands only half as much as steel when heated, and is a very poor conductor of heat. These properties make titanium suitable for use in the construction of ships, suspension-bridge cables, and jet planes.

Titanium dioxide is widely used in electrical condensers and in white pigments employed in paints and other products. Titanium tetrachloride is used in laying smoke screens. The metal is used to some extent in the production of stainless steel alloys. Metallic titanium has been produced by heating titanium dioxide with aluminum and by electrolyzing a solution of the dioxide in calcium chloride. The extraction of titanium from iron-bearing ores is very difficult because the metal adheres strongly to the iron and oxygen present in the ore; but metallurgists at the United States Bureau of Mines devised a process for turning out the metal in hundred-pound batches, and by mid-century commercial production had begun.

The symbol for titanium is Ti, the atomic number 22, the atomic weight 47.90, the specific gravity 4.5, and the melting point 1800°C.

TI′TANS, in Greek legend, the giant children of Uranus and Ge, or Gaea (heaven and earth). They were twelve or thirteen in number. Fearing their great strength, Uranus chained some of the Titans in a dark cave. Cronus (Saturn), the youngest of the lot, escaped. Later he deposed Uranus and released his brothers and sisters. He was in turn overthrown by his son Zeus (Jupiter). The word *titanic,* referring to anything of enormous scope or size, is derived from their name. The one-eyed giants called Cyclopes were Titans. See also CYCLOPES; MYTHOLOGY; URANUS.

TITHE, from the Anglo-Saxon word *tēotha,* meaning *tenth,* is the tenth part of anything, paid as a tax or as a voluntary contribution. Specifically, the term is applied to the tenth part of earnings on profit, paid in money or kind, for the support of the church or a charitable cause. Many ancient peoples practiced tithing. Among the Hebrews, the payments were provided for by Mosaic law as the tenth part of the produce of the land or of the flocks and herds. Tithes were paid to the early Christian church as voluntary contributions, but later were often exacted as church levies or by the government for the support of state churches. Today the tithe is generally voluntary, although some denominations, such as the Mormons, exact it of all members.

TITIAN, *tish′un,* [Italian *Tiziano Vecelli* or *Vecellio*] (1477-1576), a Venetian painter who was one of the world's great masters, was born in Pieve di Cadore, in the mountains of northeastern Italy. With the young painter Giorgione, he worked in the studio of Giovanni Bellini in Venice, and he was much influenced by Giorgione's style of painting. However, by the time he was thirty Titian was an acknowledged master with his own individual style.

Like most Venetians, Titian loved the texture of rich fabrics and delicate skin, which he painted with great skill. He was equally celebrated for his religious pictures, mythological subjects, and portraits. He was a powerful draftsman, and he used color as well as line in the organization of each picture. The early works were often built up,

LIVELY MOVEMENT, COMPLEX DESIGN, glowing color, and varied texture characterize Titian's "Bacchus and Ariadne," a treasure of the National Gallery in London.

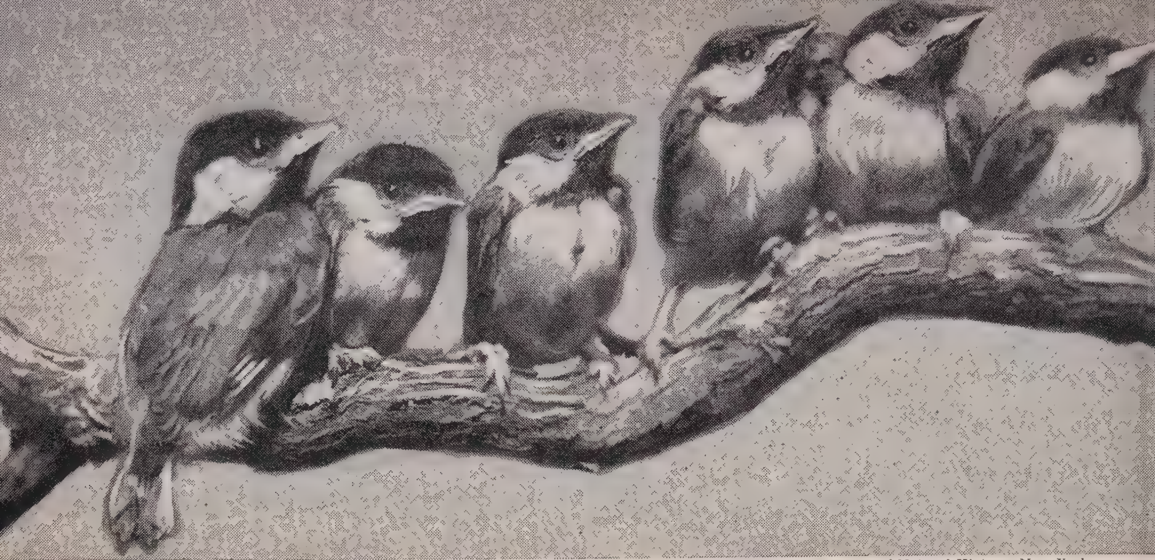
layer by layer, until a rich golden effect was achieved. Most of the women Titian painted had reddish-gold hair, which toned in perfectly with the glowing reds and browns that Titian preferred. In his later paintings Titian used a technique more like that of the Impressionists, but his color remained superb.

Throughout a long, busy, and successful life Titian produced magnificent pictures. He painted most of the important men and women of his time. The Emperor Charles V made him court painter, as did Philip II of Spain. Francis I of France sat to him, and Titian did wonderful portraits of several popes. Even in his religious or mythological pieces the painter often used his friends as models for the incidental figures. His portraits are remarkable character studies as well as fine paintings. Most of the world's great galleries contain examples of Titian's work. Among his famous paintings are "The Man with the Glove," "The Entombment of Christ" (both in the Louvre, Paris), "Bacchus and Ariadne" (National Gallery, London), "Venus," "Flora" (Uffizi Gallery, Florence), and "Sacred and Profane Love" (Borghese Gallery, Rome).

TITICACA, *tit ih kah′kuh,* LAKE, the largest lake in South America and the loftiest large lake in the world, lies in a valley of the Andes Mountains on the border between Peru and Bolivia. Lake Titicaca, whose waters are fresh, has a length of about 130 miles, an average width of 30 miles, and an area of 3,205 square miles; its elevation is about 12,500 feet above sea level. It is drained at its southern end by the Desaguadero River, which empties into Lake Poopo, a salt-water lake in Bolivia. The region around Lake Titicaca is believed to be the cradle of Inca culture. Impressive ruins of Inca and pre-Inca civilization are found along the shore and on two islands at its south end, the Islands of the Sun and of the Moon. Small steamers ply between the ports of Puno in Peru and Guaqui in Bolivia, to connect the railway systems of the two countries. Lake Titicaca is the world's highest lake with steam navigation.

TIT′LARK. See PIPIT.

TI′TLE, that which constitutes the legal ownership of property. It has two essential elements — possession and right of possession — and may be obtained by original acquisition, as in the case of a patent or copyright never previously owned; by gift, sale, or contract; or by act of law, as in bankruptcy, intestacy, judgment, or marriage. In most countries the examination and registration of titles by a recognized public official assure the purchaser of real estate of a perfect title without his personal investigation; but care should always be taken to establish the fact that title to real estate is "clear" and cannot be challenged. Titles to automobiles and ships, as well as to real estate, should always be recorded. See also ABSTRACT; DEED; TORRENS SYSTEM.


American Museum of Natural History, New York

YOUNG CHICKADEES, members of the titmouse family, observe the world with bright-eyed interest.

TITLES OF HONOR, as distinct from titles of rank or hereditary titles of nobility, are those earned by distinguished service or achievement. Military titles and titles in the Church indicate rank and position in an organized system. In some countries there are established orders of merit. Membership in these is conferred as a mark of honor, and an honorary title sometimes goes with the award of membership. In most of the Western nations a person who has earned a high academic degree such as Ph.D, LL.D, or D.Sc. is often called Doctor, as is a doctor of medicine. Mr. and Mrs., like the French *monsieur* and *madame* and the Italian *signore* and *signora,* were once titles of honor distinguishing their possessors as gentlemen and gentlewomen rather than as common people. The people of India called Gandhi *Mahatma,* meaning *great soul.*

TIT′MOUSE, a family of small, active birds which includes the titmice, chickadees, bush tits, and verdins. These birds destroy many harmful insects, especially tree pests.

The *tufted titmouse* of the east-central and southern United States is about six inches long. The upper plumage is gray, except for the black forehead; cheeks and under parts are white; and the flanks are a pale reddish brown. The tufted crest is large. The titmouse nests in a cavity in a tree or stump, and usually weaves a discarded snakeskin into the nest. Five to eight white eggs are laid. Several other species are found along the Pacific Coast, in Texas, and in Mexico.

The *bush tit* of the western United States is a small, brownish-gray bird with light under parts. Its average length is a little more than four inches. The bush tit hangs its long, pouchlike nest on the end of a branch. The *verdin,* which is found in the southwestern United States and northern Mexico, has a yellow head and neck, brownish-gray upper parts, and a pale breast. It builds its nest — a rough mass with a side opening — toward the end of a branch. See also CHICKADEE.

Scientific Names. Tufted titmouse, *Parus bicolor;* bush tit, *Psaltriparus minimus;* verdin, *Auriparus flaviceps.*

TITO, *te′toh,* real name JOSIP BROZOVICH or BROZ (1892-   ), Yugoslav Communist leader, was born at Kumrovec, a town near Zagreb, in Croatia, then part of Austria-Hungary. He served in the Imperial army during World War I; but in 1915 he was captured by, or deserted to, the Russians, and in the Bolshevist Revolution (1918-20) fought for the Red Army. By 1924 he was back in his homeland, then part of the new Yugoslavia, where he became a Communist organizer. After serving a term in prison (1929-34), he was active in the Communist underground, recruiting anti-Fascists to fight in the Spanish civil war; during this period he adopted the name Tito.

When Yugoslavia was under German occupation in World War II, Tito at first joined the resistance led by General Mikhailovich, but he soon organized his own guerrilla army, the Partisans, to fight both the Germans and the government-in-exile of King Peter. The monarchy was abolished at the end of the war, in 1945. Tito became Premier and, later, President of a people's republic on the Communist pattern. At first he supported the policies of the Kremlin, but in 1948 he broke with Russia and its satellites. This split in the ranks of Communism led to closer relations between Yugoslavia and the Western nations. In 1955, Russian delegates visited Tito for the purpose of making peace. Friendly relations were restored without

Yugoslavia's becoming a satellite of the Soviet Union. See also WORLD WAR II; YUGOSLAVIA, *History*.

TI'TUS, a Gentile convert and close associate of Paul. He was of Greek ancestry, and some modern scholars suggest that he may have been the brother of Luke, the author of the third Gospel and of the Acts of the Apostles. The conversion of Titus and his reception into the Christian community represented a step away from Judaism, since Paul gained permission to have him exempted from the Jewish rite of circumcision. He apparently was a man of ability and strength of character, and he was deeply trusted by the Apostle. Paul's Epistle to Titus indicates that Titus was serving as superintendent of the Christian mission in Crete, where, according to tradition, he was the first bishop. This letter, which is one of the so-called Pastoral Epistles, gives advice concerning the qualifications of church leaders and the moral qualities of church members, and it instructs Titus how to deal with certain errors and troublesome teachers. See also PAUL, SAINT.

TITUS (about 40-81), Roman emperor, was the eldest son of Vespasian. He served with credit as a military tribune in Germany and Britain, and he accompanied his father as commander of a legion in the war against the Jews. When, in 69, Vespasian was proclaimed emperor by his legions, Titus took over command of the Roman forces in Judea. He captured Jerusalem the next year, destroying the city, and returned to Rome for a triumphal celebration of the victory. Vespasian gave Titus a share of responsibility in the government of the empire, and Titus succeeded as emperor when his father died in 79. In his brief reign Titus made himself very popular by his open-handed generosity and his personal charm. He completed the Colosseum in Rome and built the elaborate baths of Titus. He abolished prosecutions for treason, and he did what he could to help the victims of two great catastrophies — the eruption of Vesuvius in 79 and the fire and plague in Rome the following year. When Titus died he was succeeded by his younger brother, Domitian. The Arch of Titus, a Roman triumphal arch celebrating Titus' capture of Jerusalem, was erected in 81 by Domitian. It still stands in the Via Sacra, facing the Forum. See also DOMITIAN; ROME, HISTORY OF; VESPASIAN.

TNT, or **TRINITROTOLUENE**, *try ny trotol'yu een,* one of the most powerful high explosives known, is a compound of nitrogen, carbon, hydrogen, and oxygen used extensively in modern warfare. It is a yellow crystalline solid that melts at a little below 180°F.; and when molten it is poured into shells, bombs, hand grenades, submarine mines, and torpedoes, where it solidifies. When set off by a detonator such as mercury fulminate, TNT explodes with terrific violence and speed, and the gases generated have more than 2,000 times the volume of the solid TNT. The detonator may be set off by a fuse, a timing mechanism, or the shock of contact with a target. In the absence of a detonator TNT may be handled safely, and in small amounts can even burn without exploding. It may be used alone or with ammonium nitrate to form a mixture called *amatol*. A fuse made of a TNT-filled lead pipe and a detonating cap is used to set off simultaneously several charges of dynamite or other explosives. See also DETONATOR; EXPLOSIVES.

SACKING JERUSALEM, Titus rescued the sacred vessels from the Temple.

TOAD, a squat little amphibian, closely related to the frog. The typical toad has a stout, heavy body three or four inches long, a large head, and strong hind legs which enable it to hop placidly along on its endless hunt for food. Its brownish back is covered with lumps and warts, and its grayish-white under surface is speckled with black spots. The short, stout forelegs end in separate digits, but the toes of the hind legs are usually partially webbed. The jaws of its large mouth are toothless.

The Life of the Toad. Like the frog, the toad hibernates in cold weather. Unlike the

American Museum of Natural History, New York

NATURAL CAMOUFLAGE makes the homely toad almost invisible in a setting of dirt and pebbles and enables him to escape notice.

frog, it lives on land most of the year, returning to the water during the spring breeding period. At this time the male toads inflate their throats and begin their trilling call. Each female lays several thousand eggs in long strings of jelly. If these are not gobbled up by some inhabitant of the pond, the tadpoles are hatched within a few days. During the next two months the tadpoles grow larger, the long tail is absorbed into the body, limbs are developed, and lungs replace the tadpole gills. The toad then begins its career on dry land, a career which may last over thirty years.

The toad does some of its breathing and much of its drinking through its porous skin. It secures the insects upon which it feeds by darting out its long sticky tongue, which is attached at the front of its mouth. Agriculturists should be grateful that the toad's appetite is so large, for the homely little creature helps to rid their gardens and farms of countless insect pests. The toad leads a quiet, retiring life, spending many hours half-buried in the dirt and generally avoiding attention. When attacked by an enemy, it may puff up its body or pretend to be dead, but its only efficient means of protection are skin glands which secrete a distasteful acid irritant. The ancient belief that handling toads causes warts is complete nonsense.

The common toad, which sheds and devours its own skin periodically, is a very conservative little creature in comparison with some of its exotic relatives. There are, for example, *spadefoot* toads, which dig underground burrows, and *narrow-mouth* toads, which reach only about an inch in length. The *Surinam* toads are unusual in that the female carries the developing eggs embedded in her back. In the case of the *midwife* toads, on the other hand, the male cares for the eggs, looping the long strings around his hind legs. Toads of one kind or another are found all over the world. See also AMPHIBIANS; FROG; TADPOLE.

TOBAC'CO, a genus of plants cultivated for their leaves, which are smoked, chewed, made into snuff, and in smaller measure used as a fertilizer and a fungicide. Common tobacco, the most extensively cultivated variety, is an annual plant growing from three to six feet tall. It has a shallow root, a thick central stem, and long, broad leaves. Both stem and leaves are coated with fine hairs and with a moist, gummy substance. Its flowers, which appear on a stalk on top of the stem, are pinkish or reddish and resemble those of the potato in shape. As many as a million dustlike seeds may be borne by a single plant. Tobacco is a member of the nightshade family, which has given us such useful plants as the potato, the tomato, and the eggplant, as well as such poisonous species as the deadly nightshade itself.

Kinds of Tobacco. Tobaccos may be broadly classified according to use as cigar and manufacturing types. Cigar tobaccos cost most, and costliest of all are *cigar wrappers,* the leaves which are wound about the outside of the cigar. The best come from Sumatra and Cuba. In the United States, they are grown chiefly in Connecticut and Massachusetts, where the fields are tented with cheesecloth to improve the quality of the leaves by preventing too rapid transpiration, or loss of moisture. Next in value are *cigar binders,* which underlie the wrappers; these are raised in the United States mainly in Wisconsin, Connecticut, and Massachusetts. *Cigar-filler tobaccos,* which make up the body of the cigar, are grown largely in Pennsylvania. Cigar leaf unfit for use in cigars is used in manufacturing chewing tobacco. Manufacturing tobaccos, which make up the bulk of American production. are those used in cigarettes, pipe tobacco, chewing tobacco, and snuff. Most widely grown is the richly flavored Burley of Kentucky and adjoining states. Vitally important, too, is the bright-leaf tobacco of Virginia and the Carolinas. Other well-known varieties are the dark, pungent perique of Louisiana and the aromatic Latakia of Syria and Turkey.

Tobacco is classified also according to the method by which it is cured. Curing is a vitally important process, for on it depends much of the aroma of the leaf and the value of the tobacco. In curing, the leaves subsist for several days on their stored nutrients, finally dying of starvation. Leaves injured in handling will not cure properly, nor will leaves dried too quickly or too

Federal Works Agency

THE GROWING AND CURING OF TOBACCO are shown in capsule form in this American mural.

slowly or at too high a temperature.

Air-cured tobacco is hung in barns so constructed that much of their sides and tops may be opened or closed to control humidity. The process takes several weeks. All cigar and much Burley tobacco is air-cured. In *open-fire* curing the tobacco is allowed to yellow for four or five days and then cured with slow-burning open fires of hardwood for from three to five days, producing a mottled, dark-fired leaf for smoking and chewing tobaccos. In *flue-curing,* the smoke and gases are not permitted to touch the tobacco but are piped through the tobacco house in flues leading from outside fires. The process takes about five days. Virginia, or bright, tobacco, used for smoking and chewing blends, is flue-cured. The *slow,* or *soft, cure* embraces the principles of air-curing and dark-firing. In warm weather, the tobacco is treated as in air-curing, but on cool days open fires are started to maintain a temperature of about 80°F. The process requires about a month.

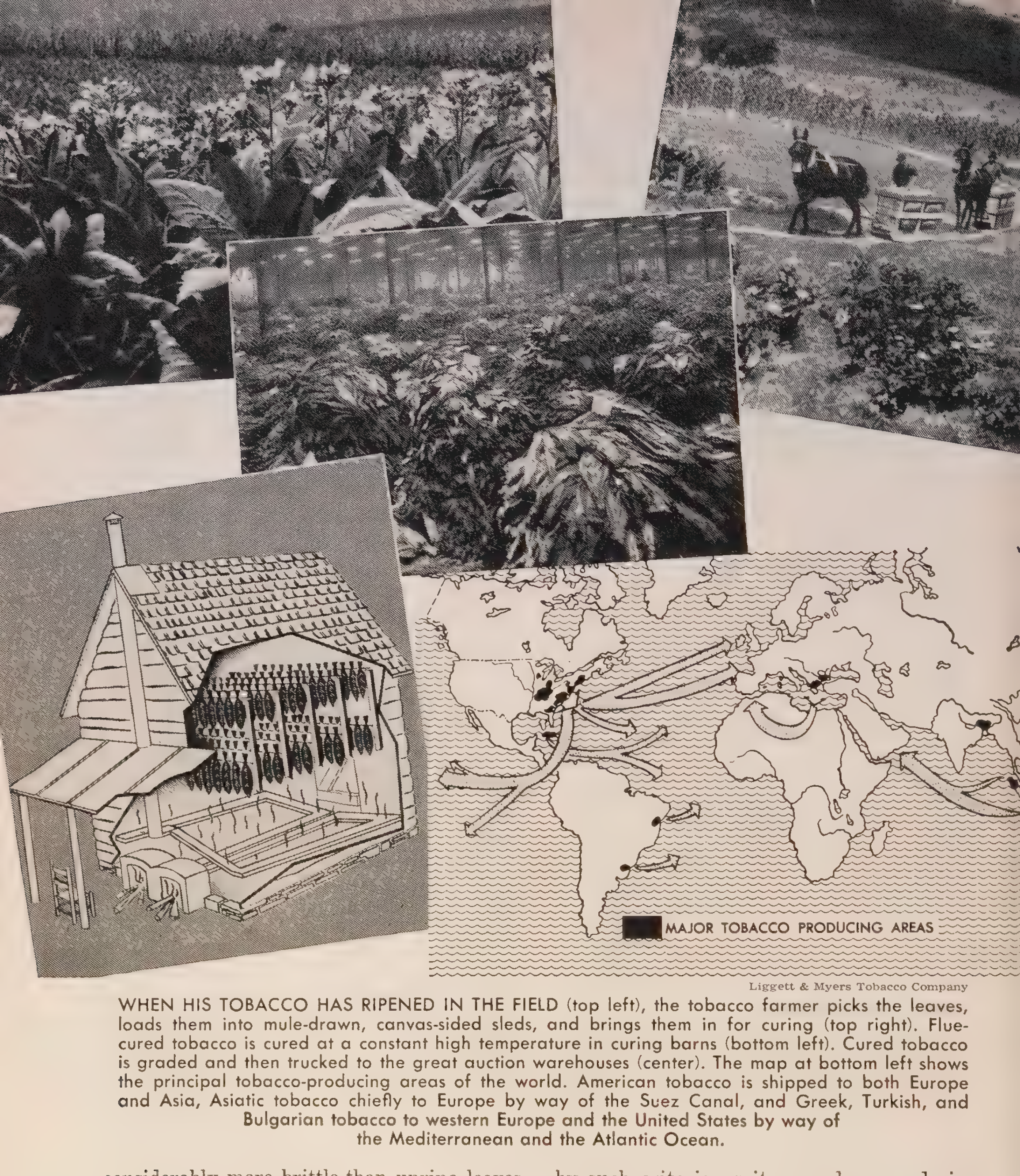
Production. Throughout the world, tobacco is the ninth most valuable crop, and in the United States it ranks sixth. The United States produces about one fifth of the world supply, and almost equal amounts are raised in India and China. It is an important crop in Russia, Brazil, Greece, and Turkey; and large quantities are grown also in Indonesia and the West Indies. In the United States, the leading tobacco-growing states are North Carolina, Kentucky, Virginia, Tennessee, South Carolina, and Georgia.

It is the expense involved in its production, largely due to the amount of hand labor required, that gives tobacco its value, and not its acreage, for tobacco is essentially a small-acreage crop. Of the farms on which tobacco is grown in the United States, about three fourths raise less than five acres and fewer than one in twenty produce as many as twenty acres of tobacco; a negligible number grow more than a hundred acres.

Cultivation. The plants are started in especially prepared beds, which are frequently sterilized by steam or by burning wood and brush. The purpose of sterilization is to kill weeds, weed seeds, insects, and certain organic diseases which otherwise destroy young plants. To insure their even distribution, the tiny seeds are mixed with wood ashes, commercial fertilizer, or some other bulky material. The plants are transplanted in a well-fertilized field when they are about six inches high, and are frequently cultivated to destroy weeds. When the plants approach maturity, they usually are *topped;* that is, their flowering stalks are broken off, in order to keep the plant nutrients in the leaves. *Suckering,* or the removal of suckers (shoots) which develop near the tops of the plants, particularly after they have been topped, must be done several times.

Diseases and Pests. Tobacco is subject to numerous diseases. Varieties have been developed which are resistant to black root rot, wilt, and mosaic, which mottles leaves, but these diseases still take a considerable toll of tobacco crops. Other destructive diseases are brown root rot, angular leaf spot, and wildfire, another bacterial leaf-spotting disease. Among protective measures are disinfecting seedbeds, using Bordeaux mixture on seedlings, and removing and destroying all infected plants. Some of the most destructive insect pests of tobacco are the tobacco hornworm, which may be controlled by Paris green or arsenate of lead; the flea beetle, which is susceptible to rotenone dusts; and the cutworm, the budworm, and the grasshopper, which are combated by poisoned baits.

Harvesting. Tobacco leaves ripen from the bottom to the top of the plant. When ripe, they turn a lighter green and become



Liggett & Myers Tobacco Company

WHEN HIS TOBACCO HAS RIPENED IN THE FIELD (top left), the tobacco farmer picks the leaves, loads them into mule-drawn, canvas-sided sleds, and brings them in for curing (top right). Flue-cured tobacco is cured at a constant high temperature in curing barns (bottom left). Cured tobacco is graded and then trucked to the great auction warehouses (center). The map at bottom left shows the principal tobacco-producing areas of the world. American tobacco is shipped to both Europe and Asia, Asiatic tobacco chiefly to Europe by way of the Suez Canal, and Greek, Turkish, and Bulgarian tobacco to western Europe and the United States by way of the Mediterranean and the Atlantic Ocean.

considerably more brittle than unripe leaves. The leaves of the best tobaccos are *primed,* that is, picked as they ripen; strung on sticks or strings; and hung in the tobacco barn to cure. Commonly, however, the entire plant is cut down when its central leaves are mature. Half a dozen plants are hung on a single stick, which is then placed in the curing house.

After the cured tobacco has become pliant by absorbing atmospheric moisture, the leaves are stripped from the stalk and sorted. The value of tobacco depends largely on how well it is sorted according to color and by such criteria as its soundness and ripeness; but since much farm sorting is crudely done, involving the mere separation of the ripe central leaves from the over-ripe lower and the under-ripe upper leaves, some experts make a profit by buying, resorting, and reselling farm-sorted tobacco. The sorted leaves are made into bundles, or *hands,* of from eight to thirty leaves, depending on their size.

Marketing. Cigar tobacco commonly is sold from the farm to a representative of the manufacturer, but most tobacco is sold at auction on loose-leaf markets. It is placed

U.S.D.A. Photograph

A TINY TOBOGGANER sits up front for an exciting swoop down a snowy hillside.

in baskets about the floor of the warehouse, where it is inspected by buyers. Sales proceed swiftly, the auctioneer announcing bids in a weird chant intelligible only to professional buyers. There are no great tobacco markets comparable to the New Orleans cotton market or the Chicago grain market; and, since only a small amount of tobacco is marketed by a standard grading system, little information as to prices is available to those with tobacco to sell.

Effects of Tobacco. Whether tobacco belongs with the beneficial or with the harmful species of nightshade has been debated since its introduction into Europe from its native tropical America in the sixteenth century. Medically, tobacco is objectionable because it contains nicotine, a poisonous alkaloid which temporarily raises the blood pressure and so makes the use of tobacco inadvisable for those suffering from circulatory diseases. The tars contained in tobacco smoke, too, are said to be harmful to the lungs. James I forbade its use in England because he disliked the smell of it, and a few years later it was prohibited in New England as an idle habit. At various times it has been proscribed elsewhere.

See also CIGAR; CIGARETTE; NARCOTIC; NICOTINE; PIPE; SNUFF.

Scientific Name. Common tobacco, *Nicotiana tabacum.*

TOBOGGAN, *toh bog'un,* a kind of sled without runners, patterned after the kind used by woodland Indians to carry loads over soft snow. The word is derived from the Algonquian. A toboggan is made of long, thin boards held together by crosspieces. At the front the boards are curved up and back, to form a sort of snowplow. The bottom is smooth and polished. A toboggan can be steered with a short stick or with a foot; but because it is light in weight and lacks runners, it is not easy to control on a steep slope. Toboggans are used for coasting on snowy hills or on artificially constructed slides. Many winter playgrounds and parks have toboggan slides that are long, straight chutes cut into the snow.

TOGA, *to'guh,* the chief outer garment worn by men in ancient Rome. The toga, which was probably adapted from a similar Greek mantle, was an elliptical piece of woolen fabric worn draped around the body. Roman citizens wore the plain white toga (the *toga virilis*) as a badge of citizenship. The emperor's toga was purple. Senators, other officials, and boys wore the purple-bordered *toga praetexta.* Sometimes the Romans used darker togas of unbleached wool as a symbol of mourning or to indicate that the wearer was going through religious ceremonies. See also DRESS, *Greeks and Romans.*

TO'GO, HEIHACHIRO, MARQUIS (1847-1934), Japanese admiral, entered the navy at sixteen and later spent about seven years in England, studying naval science. He distinguished himself in the first war between

Ewing Galloway

EARTHQUAKES, AIR RAIDS, AND TYPHOONS have not prevented Tokyo from being the leading metropolis of the Far East and one of the great cities of the entire world.

China and Japan (1894-95), and at the outbreak of the Russo-Japanese War in 1904 he was in command of the main fleet. After his brilliant victories over the Russians at Port Arthur and in the Battle of the Sea of Japan (1905), in which the Russian naval forces were destroyed, Togo became a national hero. He was made a count in 1907 and was named admiral of the Japanese fleet in 1912. In 1934 he was created a marquis.

TO′GOLAND, or **TO′GO**, a United Nations trust territory in West Africa north of the Gulf of Guinea under British and French administration. British Togoland, on the west, has an area of 13,041 square miles and French Togo, on the east, has 21,893 square miles. The natives, numbering about 1,350,000, are divided into many tribes and speak more than forty languages; because of the hot and humid climate there are very few Europeans. The chief products are cocoa, cotton, coffee, copra, palm oil, and rubber. Togo became a German protectorate in 1884, but in 1914 during World War I it was captured by the British and French. In 1922 it was made a League of Nations mandate and divided into British and French areas. It became a United Nations trust territory in 1946.

TOKYO, *to′kih oh,* JAPAN, the capital and largest city of the country, is situated near the head of Tokyo Bay on the southeastern shore of the main island of Honshu. Its population of slightly more than 6,000,000 before World War II made it the third largest city in the world; it now has about 3,500,000 inhabitants. The Sumida River and many smaller streams flow through the city, providing a system of waterways for small boats. Tokyo is the center of a great metropolitan region which spreads along the western shore of the bay; adjoining it on the south is the industrial city of Kawasaki, and a few miles beyond is the great seaport Yokohama. Below Yokohama and near the entrance to Tokyo Bay is Yokosuka, formerly Japan's chief naval base.

In the center of Tokyo is the imperial palace, built in a combination of European and Japanese architecture and surrounded by beautiful grounds and modern government buildings. Not far away is Hibiya Park, which is used for political and cultural activities. East of the palace is the business section, with many modern buildings. Hydroelectric plants in the nearby mountains provide abundant power for Tokyo's diversified industry. The city is also the financial center of the country and the hub of the railroads, airlines, highways, and telephone and telegraph lines. It has a number of colleges and universities, the most important of which are Tokyo Imperial, Keio Gijuku, and Waseda. Features of interest are the Imperial Museum, the Imperial Library, the temple of the goddess of mercy, and Ueno Park with its cherry-blossom grove and zoological gardens.

Tokyo developed from the fishing village of Edo, or Yedo, which was first mentioned in the late twelfth century. In 1603 Iyeyasu

Tokugawa, the feudal baron of Yedo, seized control of Japan and founded the Tokugawa dynasty of military governors, or *shoguns*. Yedo then became the shogunate capital of Japan. The shogunate period lasted until 1867, when Emperor Meiji at last regained the imperial authority. Two years later the imperial capital was moved from Kyoto to Yedo, which was renamed Tokyo, meaning Eastern Capital. The old shogunate palace was burned in 1873, and the new imperial palace was completed on the same site in 1889. Tokyo has suffered from many earthquakes and typhoons. In 1923 it was struck by one of the most destructive earthquakes in world history; a large part of the city was destroyed and about 150,000 people perished in Tokyo and the nearby cities. The city was rapidly rebuilt on Western plans, with sturdier buildings, broader streets, and more parks. Again during World War II more than half of the city was devastated by American air raids. The formal terms of surrender were signed on the decks of the battleship "Missouri" in Tokyo Bay on September 2, 1945. During the postwar occupation period Tokyo was the headquarters of the Supreme Command of the Allied Powers. See also JAPAN.

TOLEDO, *toh le′doh,* OHIO, the fourth largest city in the state and the seat of Lucas County, is situated in northwestern Ohio on the Maumee River about nine miles from the main body of Lake Erie. Called the "Pivot City of the Great Lakes," Toledo ranks second after Duluth-Superior among the ports of this inland waterway system, and in total tonnage handled it is one of the world's foremost ports. It ships out more bituminous coal than any other city in the world. Its nine major railroads and seven other rail lines make it the third greatest rail center in the country.

Toledo stretches about fifteen miles along both banks of the river to Maumee Bay, an arm of Lake Erie at its southwestern tip. Extending along this natural harbor is a large industrial region, which utilizes and distributes huge quantities of coal, iron ore, petroleum, grain, and other bulk products. Toledo leads the world in the manufacture of glass, and it ranks high in the making of automobiles and automotive parts and accessories and in oil refining. Other important products in Toledo's diversified industry include machine tools, steel and iron goods, electrical appliances, chemicals, flour, cereals, and other food products.

The main business section, situated on a slight elevation a short distance west of the river, has many imposing buildings. Most of the major streets extend outward from the business section in an irregular radial design. Points of interest include the Museum of Art, which houses the Libbey glass collection, one of the largest of its kind in the world; the site of Fort Industry, built by Anthony Wayne in 1794; St. Frances de Sales Cathedral (Catholic); the University of the City of Toledo; and De Sales College (Catholic).

At the Battle of Fallen Timbers, a short distance south of Toledo, General "Mad" Anthony Wayne in 1794 crushed the strong Indian challenge to white supremacy in the Northwest Territory. In 1805 the Indians gathered at Fort Industry to cede a large tract of land to the United States. Settlement began with the founding of two towns, Port Lawrence in 1817 and Vistula in 1832; these towns were united in 1833 under the name of Toledo. The bloodless "Toledo War" (1835-36) was a dispute between Ohio and Michigan over a strip of territory at the mouth of the Maumee including the city of Toledo. Congress finally recognized the claim of Ohio. Toledo was incorporated in 1837; it has the city-manager form of government. The population is over 301,000.

TOLERA′TION ACT, a law granting religious tolerance. Specifically, the term refers to an act passed by the English Parliament in 1689 granting some measure of religious freedom to Protestant dissenters who had helped the Anglicans force the Catholic James II from the throne in 1688. The act modified the Test Act of 1673. Religious freedom was still denied to Catholics, Unitarians, and Jews, but in practice these groups were permitted to worship as they pleased.

In the American colonies the Maryland assembly passed an act in 1649 which granted religious toleration to all except Unitarians and Jews. In Rhode Island the code of 1644 permitted full freedom of worship; in Pennsylvania, William Penn's great charter of 1682 extended this right to all who acknowledged God. Most of the state constitutions drafted in the Revolutionary War period (1776-80) provided for religious freedom. See also NONCONFORMISTS; TEST ACTS.

TOLL, *tohl,* a tax paid, or duty imposed, for some service or privilege, or for the privilege of using something over which the grantor has proprietary rights. English boroughs once gained much of their revenue through tolls; today many of the same taxes are levied but are usually called licenses. During the Middle Ages feudal lords commonly forced travelers and traders to pay toll for passing over their lands or waters. Formerly in the United States and Europe many toll roads and bridges were built by individuals or private companies. Toll gates were set up to collect payment from all users; the rates were regulated by law. Today most roads and bridges are built and maintained at public expense and are open to all without charge. Recently, however, superhighways,

Public Roads Administration

IN THE EARLY NINETEENTH CENTURY toll roads like Kentucky's Maysville Turnpike played an important part in the development of America's great highway system.

such as the Pennsylvania Turnpike, and bridges, like the great Triborough Bridge in New York City and the San Francisco-Oakland Bay Bridge, have been constructed and tolls charged for their use. Such public toll roads and bridges become free as soon as the cost of construction is paid.

TOLSTOI′, LEV (LEO) NIKOLAEVICH, COUNT (1828-1910), world-famous Russian author, wrote some of the greatest novels in all literature and achieved the highest success but never found complete happiness or satisfaction. His last years were spent in crusading for sweeping social and religious reforms and in seeking personal salvation.

Tolstoi was born on the family estate of Yasnaya Polyana in the province of Tula. He received a good education but gave up his studies at the University of Kazan at the age of nineteen. In 1851, after four years of youthful extravagance, he took part in military action in the Caucasus and, soon afterward, served in the Crimean War. His early writings, *Childhood, Boyhood,* and *Youth,* published between 1852 and 1856, had made no great impression; but *Sevastopol* (1855), a realistic account of the famous siege, quickly established his reputation.

Tolstoi's interest in social reform began during his university days, and travels in western Europe increased his desire to help the Russian serfs. As the years passed, his efforts in their behalf continued, but his growing concern with such problems did not dominate his writings. *The Cossacks* (1862) is a colorful, realistic picture of life in the Caucasus. It was followed by Tolstoi's masterpieces, *War and Peace* (1869) and *Anna Karenina* (1878), often considered the greatest of Russian novels. Then, at the age of fifty, Tolstoi turned his back on literature and became a religious philosopher, preaching a code of basic Christian morals. He called for universal brotherhood, humble toil for the good of others, and self-purification through nonresistance to evil. The former dandy dressed in a rough peasant's smock and worked in the fields. His constant attacks on organized religion led to his excommunication by authorities of the Russian Orthodox Church. In works like *A Confession* (1884) and *What Is to Be Done?* (1886), he set forth his doctrines. *Resurrection* (1899), his last important work of fiction, was written to secure funds for an oppressed Russian religious sect.

Tolstoi's views were resented by his wife and other members of his family, and his home life became increasingly unhappy. At last, driven almost mad by the daily tension and by the urgings of his conscience, he abandoned all his earthly possessions and set out in a last frantic attempt to win the inner peace which was always his goal. He died at the age of eighty-two in a cottage which was made a permanent shrine in 1945.

Tolstoi's monumental *War and Peace,* a novel about Russia during the Napoleonic campaigns, is a mighty prose epic. It is gigantic in scope, filled with brilliant scenes and magnificent episodes, a breathtaking work in its power and energy. Tolstoi, the master realist, describes the various levels of Russian society with marvelous clarity and ruthlessly destroys any false conceptions of war's romance and glamour. In *Anna Karenina* he works with a far smaller canvas, achieves perfect artistic structure, and creates unforgettable characters. Lesser examples of his genius are the novels *The Death of Ivan Ilyitch* and *The Kreutzer Sonata,* the stories "Two Old Men" and "Where Love Is, There God Is Also," the play *The Power of Darkness,* and the famous essay "What Is Art?" Tolstoi was one of the literary giants of modern times and one of the most fascinating personalities of his age. *Leo Tolstoy* (1946), by Ernest J. Simmons, is a remarkable study of his life and character.

TOL′TEC, a people who came into the valley of Mexico in the seventh century long before the arrival of the Aztecs. The Toltec capital, Tollán, was not far from modern Mexico City. The Toltecs knew how to work metals, and they built tall stone pyramids as bases for shrines dedicated to their gods. There are many ancient Toltec ruins at Teotihuacán. The Toltecs spoke a language related to Nahuatl, the Aztec speech, and their culture evidently influenced both the Aztecs and the late Mayas. Their god Quetzalcoatl, or the Plumed Serpent, was important in both of these cultures. The Toltec period in the valley ended about 1100, when, for some reason, the Toltecs were forced to move south and disappeared as a people. See also AZTEC; MAYA.

TOM'AHAWK, from an Algonquian Indian word, is the name of a spiked war club once used by most of the Indians in eastern North America. Originally the Indians made a tomahawk by fastening a rock or deerhorn to a wooden handle, with hide thongs. After the arrival of the whites, they substituted a metal blade. Finally, tomahawks shaped like little hatchets were made in Europe for the Indian trade. They were used in ceremony as well as in war. The Eastern Indians invited co-operation on the warpath by sending a messenger with a tomahawk or hatchet, which he threw at the feet of the neighboring war chief. If it was picked up, the war alliance was accepted. The expression for making peace was "burying the hatchet."

TOMA'TO, a perennial plant of the nightshade family, widely grown as an annual for its edible fruits. The odorous, hairy, trailing plants may grow to twenty feet long, but lengths of from four to eight feet are commoner. The fruits are thin-skinned berries containing a juicy pulp of delightful flavor. Most are roundish, but pear-shaped varieties also are grown. In color they may be creamy-white, yellow, orange, pink, or scarlet. They have a wide range, also, in size and weight; the small currant tomato weighs only a fraction of an ounce, while the huge Ponderosa tomato averages about one pound and may often weigh two or three pounds. Some tomatoes have an almost liquid pulp, well adapted to juicing; others have a thick, meaty, usually less acidulous pulp, excellent for slicing and canning.

Cultivation. Tomatoes thrive best in a deep, rich, moist, well-drained soil. Because they require a long season of hot weather in order to mature, they are usually started under glass from four to eight weeks before the frost-free season begins. When transplanted, they are set more deeply in the soil, for roots grow along their buried stems, increasing their food supply. They are usually spaced from three to four feet apart, but when, for reasons of space, they are trained on stakes as single-stem plants, they may be set as closely as eighteen inches.

The more thoroughly the plants are harvested, the more abundantly they produce. Toward the close of the season, before the first hard frost, the unripe tomatoes on the plants may be harvested, placed in straw, and stored in a moderately cool, dark place to ripen. If the plants are pulled up and hung head down in a moist, cool place, the fruits they bear will continue to ripen for several weeks.

U.S.D.A. Photo

TRAINED ON STAKES, a wilt-resistant variety of tomatoes produces a high yield of glossy fruits.

Tomatoes as Food. Tomatoes are an excellent source of vitamin C, a good source of vitamin A, and a fair source of vitamin B_1. Fresh tomatoes are eaten raw, mainly in salads, and are cooked in countless ways. Tomatoes are marketed also as a canned vegetable and as puree or paste, catsup, chili sauce, soup, juice, and preserves. The green fruit is pickled.

Diseases and Insects. *Fusariam wilt,* which causes the leaves to turn yellow and die from the bottom upwards, is best controlled by using resistant varieties of tomato such as the Marglobe. *Leaf spot,* which appears as small dark, gray-centered spots on the leaves and may eventually defoliate the plants; *nailhead rust,* caused by the organism responsible for early blight of potatoes; *late blight,* another potato disease; and *bacterial canker, bacterial spot,* and *speck,* which cause discolored spots on fruits, all may be controlled by Bordeaux mixture or copper-lime dust. *Mosaic,* a virus disease that causes mottling of the leaves and dwarfing of the plants, is controlled by destroying infected plants, weeds of the nightshade family, and plant refuse and by including plants not of the nightshade family in the rotation. *Blossom-end rot,* a physiological disease, is caused mainly by a deficiency of moisture.

The *tomato aphid* may be controlled by spraying infested plants with nicotine sulfate. Bordeaux mixture containing five tablespoonfuls of lead arsenate to the gallon is effective against the *tomato flea beetle,* which chews holes in the leaves of young plants. The *tomato horn worm,* a huge caterpillar similar to the tobacco worm, and the *tomato fruit worm* (the corn-ear worm) may be controlled by sprays or dusts of lead arsenate. The *cutworm* and the *Colorado potato beetle* are other insect pests of tomatoes (see CUTWORMS; POTATO BUG).

History and Production. The tomato is native to Central and South America. Since large-fruited species have never been found there in the wild state, the tomato is believed to have been developed by the Indians before the discovery of America. It appears to have been introduced into Europe about the middle of the sixteenth century, but for many years it was regarded as poisonous and was cultivated only as an ornamental plant.

Not until 1835 was the tomato adopted as a food in the United States, though its use as such had begun considerably earlier in Europe. Thereafter, it grew rapidly in popularity, despite lingering prejudice. Today it is second in value only to the potato among vegetable crops grown in the United States, it is the most valuable vegetable grown in greenhouses, and it leads all other vegetables as a canning food.

Commercial production of tomatoes for marketing as fresh vegetables, chiefly in California, Texas, Florida, New York, and New Jersey, annually exceeds twenty-five million bushels (about fifty-three pounds to the bushel). California, Indiana, Maryland, New Jersey, Pennsylvania, and New York lead in the production of tomatoes for processing, for which from two to three million tons are grown yearly.

Scientific Name. *Lycopersicon esculentum.*

TOMB, *toom,* a burial structure or chamber, built either above or below the ground. Tombs are built to honor the dead and to give expression to the belief in immortality. Tombs are of many types. Many prehistoric and primitive peoples built barrows or cairns of earth or stone; some of the mounds of the American Midwest were constructed for burial purposes. The most impressive tombs ever built are the pyramids of Egypt, which were constructed as royal sepulchers; later dynasties of Egyptian kings, however, were buried in great chambers cut into rock. The Jews hewed their tombs out of rock; Christ was buried in such a tomb belonging to Joseph of Arimathea.

Greek tombs were generally simple, but Greek colonists in Asia Minor built imposing structures, the most notable being the tomb of King Mausolus; from the name of this tomb, one of the Seven Wonders of the Ancient World, comes the word *mausoleum.* The Romans built elaborate structures for the repose of their dead, the most impressive of them being the tomb of Emperor Hadrian. The Appian Way outside Rome was lined with tombs. The Romans also hewed out great underground chambers with wall niches for the bodies of families or communities; in such chambers, or *catacombs,* the early Christians buried their dead.

During the Middle Ages distinguished persons were honored by burial in churches. Westminster Abbey, for example, contains the tombs of British sovereigns and other distinguished men. In Paris a military sepulcher is the Dôme des Invalides; here in a magnificent sarcophagus lies the body of Napoleon I. Many imposing tombs were built during the Renaissance and in early modern times, but since 1800 the structures have been less elaborate.

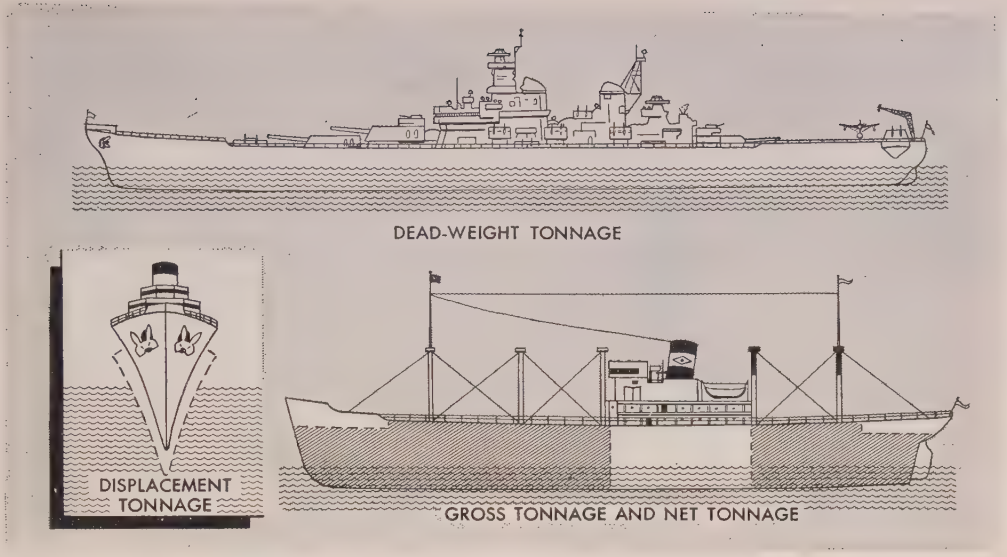
Among the impressive tombs in the United States are those of Abraham Lincoln in Springfield, Ill.; Ulysses S. Grant in New York City; and the Unknown Soldier in Arlington National Cemetery near Washington, D. C. Beautiful tombs are not numerous in Asia, but the Taj Mahal in Agra, India, is perhaps the most exquisite building in the world. See also BURIAL; CATACOMBS; MAUSOLEUM; PYRAMIDS; WESTMINSTER ABBEY.

TOMBIG'BEE RIVER, a river which rises in northeastern Mississippi and follows a general southeasterly course to enter Alabama; here it unites finally with the Alabama River to form the Mobile and Tensaw rivers, which flow about forty miles southward into Mobile Bay. The chief tributary of the Tombigbee is the Black Warrior. The Tombigbee is about 409 miles long and is navigable for small craft to Columbus, Miss.

TOMSK, SOVIET UNION, a city of west-central Siberia, is located on the Tom River not far from its junction with the great Ob River. A short branch line to Taiga connects the city with the Trans-Siberian Railway. Tomsk, the capital of the Tomsk Region, is an industrial city and an educational and cultural center. It was founded in 1604 as a fortress. The population is about 141,000.

TOM'TIT. See TITMOUSE.

TON, *tun,* a measure of weight in the English system. In the *short* ton used in the United States there are 2,000 avoirdupois pounds, equivalent to 20 short hundredweight of 100 pounds each, and also to 907.18 kilo-



A 40,000-TON BATTLESHIP (top) is one which displaces 40,000 tons of water when afloat. By subtracting the displacement tonnage of an unloaded cargo vessel from the displacement tonnage of the same vessel loaded (left) the dead-weight tonnage of the cargo can be determined. In a cargo vessel like that at bottom, the gross tonnage of all the enclosed space, minus the tonnage of those spaces which provide no income (white spaces), equals the net tonnage, which is the tonnage of the cargo-carrying areas (diagonal shading).

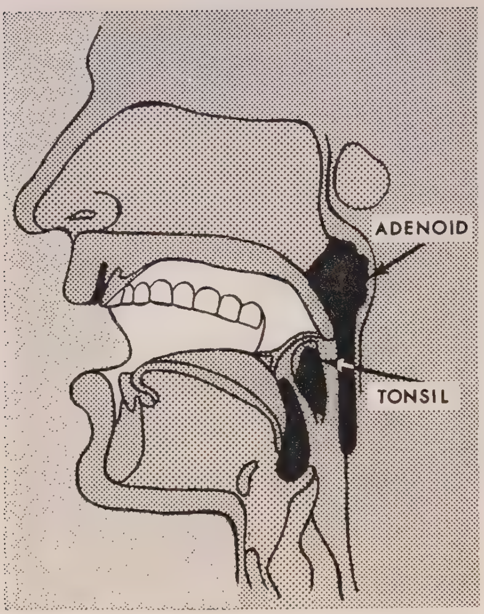
grams, approximately, in metric units. The *long* ton, the commonly used British unit, is also used in some industries in the United States. It contains 2,240 avoirdupois pounds, equivalent to 20 long hundredweight of 112 pounds each, and to approximately 1,016.05 kilograms. In the metric system a weight of 1,000 kilograms is called a *tonne,* or metric ton. It is equivalent to 2,204.62 pounds avoirdupois. See MEASURES.

TONE, in music, is the sound produced by the vibration of a musical instrument or by the human voice (see MUSIC; SOUND). Nearly every musical sound is composite; that is, it consists of several simultaneous tones with different rates of vibration, which depend on the nature of the vibrating body and the mode of producing its vibrations. These several tones are called *partial tones.* The one having the lowest rate of vibration and the loudest sound is termed the *prime, principal,* or *fundamental, tone;* the other partial tones are called *harmonics,* or *overtones.* See also HARMONICS.

TONGA, *taung'guh,* **ISLANDS**, or **FRIENDLY ISLANDS**, an archipelago in the south-central Pacific, comprise a Polynesian kingdom under the protection of Great Britain. The 150 or more islands making up the Tonga Islands are divided into three main groups — Tongatabu, Vavau, and Haabai; they cover an area of some 269 square miles and have a population of about 45,000, including some 200 Europeans. The climate is moderate, the rainfall abundant, and the soil productive. Copra and bananas are the chief exports. The natives are Christians and most of them can read and write. The islands were visited by the Dutch explorer Tasman in 1643; in 1773 Captain Cook named them Friendly Islands because of the peaceful attitude of the natives. Great Britain proclaimed a protectorate over the islands in 1900. The capital is Nukualofa on Tongatabu, the largest island in the Tongas. The government is in the hands of a native queen who is assisted by a legislative assembly.

TONGUE, *tung,* the thick, muscular organ that lies on the floor of the mouth. The tongues of vertebrate animals show many interesting adaptations. In fishes, for example, the tongue cannot be protruded from the mouth but seems to serve merely as an organ of taste. The sticky tongue of frogs and toads is attached at the front of the mouth so that it can be thrust out rapidly to catch insects. Snakes have a cleft tongue, which is used as an organ of touch.

In human beings and most other mammals the tongue not only constitutes the principal organ of taste but also aids in chewing and swallowing food and in forming sounds. The back of the tongue is attached to the hyoid bone, and the front is free to move in all directions. On the outside, it is covered with a mucous membrane in which the taste buds are embedded; internally, it is composed of muscles whose fibers extend in many directions. Like the other parts of the body, the tongue is subject to a number of disorders.



VALUABLE SAFEGUARDS of children's health, tonsils and adenoids may become infected and have to be removed.

The commonest is *glossitis,* or inflammation of the tongue. This may be caused by local infections, damage due to jagged teeth or poorly fitted dentures, or excessive use of alcohol, tobacco, and other irritating substances. It may also be a symptom of disease in other parts of the body, such as scarlet fever, anemia, vitamin deficiency, or skin disease. See also TASTE.

TONNAGE, *tun'ij,* in shipping, is the measure of the capacity of a vessel, used in charging duties and in setting fees for dockage, towing, and canal passage. Tonnage in this sense differs from measurement of the actual weight in tons (2,000 pounds) of a vessel and of a cargo. Actual weight, or *displacement* tonnage, is equal to the weight of the water displaced by a vessel afloat; and the difference between the displacement tonnage of a loaded vessel and the displacement tonnage of an unloaded vessel is the actual weight, or *dead-weight* tonnage, of the cargo. Only battleships, cruisers, and other naval vessels, however, are normally described in terms of displacement tonnage.

Shipping tonnages concerned with capacity are gross tonnage and net tonnage. *Gross* tonnage is calculated at the rate of one ton for every hundred cubic feet of enclosed space on a vessel, both above and below decks, with a few exceptions. To arrive at the *net,* or *register,* tonnage, the volume of such areas as the living quarters of the crew and the spaces filled with machinery and fuel is subtracted from the gross tonnage. The net tonnage figure measures the capacity of those parts of the ship which may be occupied by passengers and cargo and therefore produce income. The tonnage of the cargo space itself is calculated at the rate of one actual ton (2,000 pounds) per forty cubic feet of volume. Different governing authorities vary in their interpretation of gross and net tonnage. (See illustration, preceding page.)

TON'SILS, the small, spongy masses of lymphoid tissue located in the throat. As used by most persons, the term refers only to the oval-shaped *palatine,* or *faucial,* tonsils, which lie in hollows at the sides of the throat. But the adenoids, situated in the passage between the nose and throat, and two smaller bodies at the base of the tongue are also regarded as tonsils. Together, these masses form a ring about the throat and serve to protect the body against the invasion of disease-causing micro-organisms.

If the palatine tonsils become infected, tonsillitis may follow. Such infections occur most often during the winter and spring and commonly attack children from five to ten years old. The tonsils become enlarged and inflamed and ooze pus; sore throat, chills, fever, headache, and swollen neck glands usually accompany the infection. When tonsillitis is suspected, the child should be put to bed, given plenty of liquids to drink, and supplied with an ice collar to relieve pain. Severe cases require the care of a physician. Repeated attacks sometimes lead to chronic tonsillitis, which is best cured by removal of the tonsils. A tonsillectomy, however, should be performed only when necessary, not merely as a matter of routine. See also ADENOIDS; QUINSY.

TONSURE, *ton'sh'r,* a religious observance in the Roman Catholic and Eastern Orthodox churches, whereby priests and monks shave or cut their hair in a prescribed manner to denote dedication to the special service of God. The practice appeared during the fifth century; later it was adopted universally to designate admission to the clerical order. Various forms became prevalent. The Roman Church adopted the tonsure of St. Peter, which consisted in shaving the crown as well as the back of the head, leaving a circular ring of hair; this tonsure is retained only by monks. In the tonsure of St. Paul used in the Eastern Church the whole head was shaved, and in the Celtic tonsure the forward half of the head was shaved.

In modern times clerics of the Roman Church in many lands are obliged to wear the tonsure, a shaved spot on the crown of the head about the size of a half dollar. However, in English-speaking countries this practice is not observed. The only form of tonsure common to all Roman Church clerics is the token clipping of the hair in First

Tonsure, the preliminary step to receiving Minor Orders, which makes the candidate officially a cleric.

TONTY, *ton'tih*, Henry de (1650-1704), the trusted companion and friend of the explorer La Salle, was one of the founders of Illinois. Tonty was born, probably in Paris, of an Italian father and a French mother. He lost his right hand during his service in the French army, and he afterwards wore an artificial, metal one that gave him the nickname "The Man with the Iron Hand." He came to the New World with La Salle in 1678 and took part in explorations of the Great Lakes region and the Mississippi Valley. In March, 1680, La Salle left him in command of Fort Crèvecoeur, near Peoria, but late in the year Tonty was forced to abandon the position and make a difficult journey back to Green Bay. He later rejoined La Salle and helped to build Fort St. Louis, on the Illinois, and in 1682 he went with La Salle to the mouth of the Mississippi. From 1683 to 1700 Tonty was chiefly in Illinois, organizing colonies and establishing peaceful commerce. After he learned of La Salle's death, he made another journey down the Mississippi in search of survivors of La Salle's colony; and toward the end of his life he joined a new group of settlers near the mouth of the Mississippi. Tonty was an able, just, and fearless commander, and a man of great personal charm. He did much to conciliate the Indians and establish peace in the Illinois territory. Daniel Duluth, the explorer of the Lake Superior area, was his cousin.

TOOLS. Without tools man would still be living a completely primitive life. With them, early man was enabled to dominate his animal enemies and to enjoy an easier, happier existence. For hundreds of thousands of years he struggled along with only the simplest tools, but when he came to realize the tremendous power that adequate tools gave him he required only a few centuries to bring them to a remarkable state of usefulness. Modern tools are either manipulated by hand or operated by power.

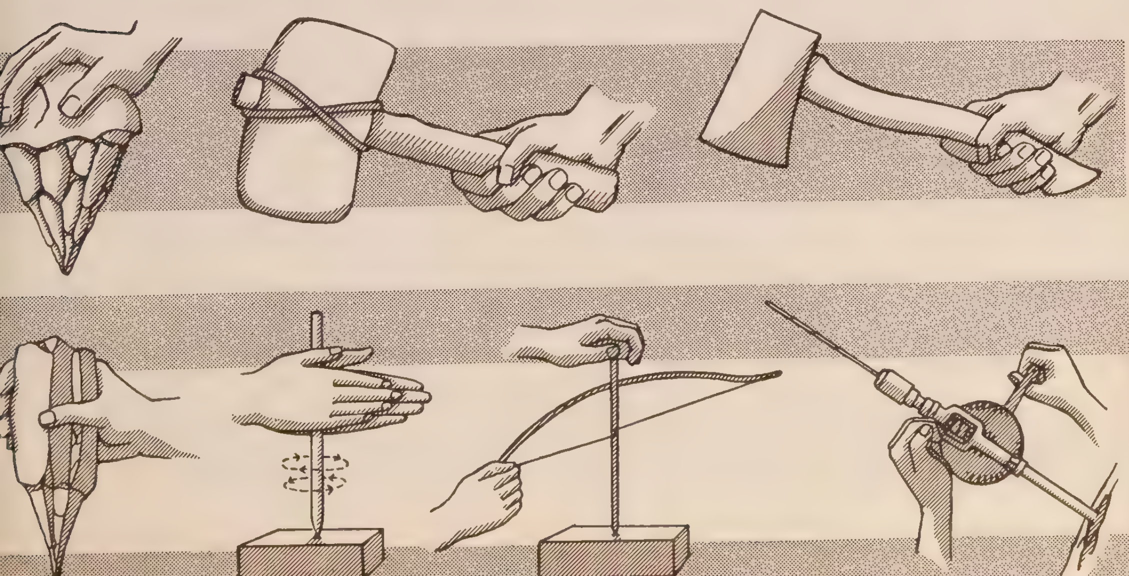
Hand Tools

Early History. The prehistoric man who first used a stone to crack open an animal bone was the inventor of the first tool. This simple hammer probably served man for a very long time, but by the Early Stone Age, between 35000 and 15000 B.C., he was chipping flint into rude hammers, scrapers, and axes. In those regions of the world where lumps of metallic copper were found, early man discovered that he could shape this material by hammering and beating. It may be that the lever, in the form of a pole or wooden crowbar, was applied for the first time by a man of this period to pry up a heavy rock; but, since implements of wood and bone have not survived the passing centuries, evidence of their earliest use does not exist.

Flint hammers, scrapers, and axes of the Neolithic or Later Stone Age (15000 to 5000 B.C.) were polished and provided with sockets for handles. The knife, originally a flint saw with a roughened edge, was gradually developed into a thin, sharp blade. Flint knives gave way to knives of copper, bronze, and iron. The adze, in the form of a flat, sharp stone, was one of man's first tools. When bronze became available as a hard, edge-retaining material, the adze very nearly approached its present-day form.

During the Bronze Age (3000 to 1000 B.C.) hammers, adzes, knives, files, rasps, chisels,

THE HATCHET, THE DRILL, AND OTHER HAND TOOLS of today were developed gradually from the crude implements of chipped flint used thousands of years ago by prehistoric man.



saws, augers, piercing tools, sickles, and axes were cast in molds and finished by polishing and hammering, becoming rather common tools. The Egyptians, Assyrians, and Italians perfected similar forms of saws, files, shears, scissors, and drill braces for work in wood, stone, and metal. The advent of the Iron Age around 1000 B.C. and of the use of steel several centuries later made possible the development of most of the elementary hand tools in the forms in which they are used today. By the opening of the Christian Era, most of the fundamental tool forms had been invented and developed to a high degree of efficiency. The contributions of later inventors consist primarily of new materials for these tools and better means of holding and driving them.

Hammer and Mallet. The origin of the hammer, as a stone held in the hand, goes far back into prehistoric times. The wooden mallet in the club form was probably used between 3000 and 2000 B.C., and the modern mason's form of mallet soon afterwards.

The Ax, Adze, and Knife, already mentioned, developed in much the same way as the hammer. Handleless axes were known about 6000 B.C. Between 3000 and 1500 B.C. the Egyptians adopted a curved-blade type to which a handle could be attached; this form was reinvented in South America and later carried to Europe.

The Saw. The original flint saw, a flat tool with a roughened edge, was converted to bronze in Egypt around 3000 B.C.; it was not until about 900 B.C., however, that the Italians conceived the idea of giving rake to the teeth so as to make the saw an actual cutting tool instead of a scraping device. At about the same time the Egyptians and Assyrians were using iron saws; the Egyptians, in fact, inserted teeth of steel, corundum, and gem stones in their saws.

The Chisel. The Egyptians and Assyrians developed and used chisels, but it remained for the Italians, about 600 B.C., to produce fine, even blades, to design the tang type for real durability, and to provide the socket types with flanges and webs for strength under impact.

Shears and Scissors. The Italians invented iron scissors in 400 B.C. Egyptian scissors had a detachable blade for ease in sharpening.

The Drill. The drill was developed from a stick rotated between the hands or by means of a bow string. The Assyrians perfected the drill brace during the seventh century B.C. At first sand or some other abrasive was rubbed between drill and work piece, but in time the drill itself was given cutting edges.

Modern Hand Tools. With the exception of a great many measuring devices, very few really new forms of hand tools have been developed during the past thousand years. The perfection of precision work, stimulated by the Industrial Revolution, created a demand for accurate measuring instruments and precision gauges for checking dimensions. Today's machinists, mechanics, and craftsmen are unable to boast of many tools which their great-great-grandfathers did not have; but they do have at their disposal tools which in accuracy, durability, efficiency, and ease of handling certainly are better than the ancients ever dreamed of.

Machine Tools

The abundance and the variety of material goods enjoyed by man in the progressive nations of the modern world are primarily the result of a relatively new set of tools — the power-driven machine tools of industry. These have enabled millions of individuals to possess a variety of equipment which furnishes them with a standard of living superior to that enjoyed by royalty in ancient times.

Related Articles. For further information, consult the following titles:

Inclined Plane
Industrial Revolution
Knife
Lever
Machines, Simple
Machine Tools and Machining
Pulley
Wedge
Wheel and Axle

TOP, a child's toy that is usually shaped like a cone ending in a sharp point. When a string is wound around the top and then pulled off with a sharp jerk, the top begins to spin on its axis, and it will spin until friction with the air and with the surface touched by its tip reduces its momentum. When it slows up, it wobbles and falls on its side; but while it is spinning it is remarkably stable and can be balanced on a finger or on a string. Tops as playthings seem to have been known since early times in many parts of the world. An early kind of top still used is the whipping top, which is kept spinning by carefully directed blows of a whip. Children become expert in handling tops, and there are many games played with different kinds of the toy. The gyroscope is an instrument like a top (see GYROSCOPE).

TO'PAZ, a mineral which in the transparent, crystalline form is the well-known gem stone. Though colorless when pure, topaz may be red, red-violet, or a pale tint of pink, blue, or green, but is more commonly wine-yellow, yellow-brown, white, or gray. By gentle heating and slow cooling the yellow stones may be changed to pink. The yellow varieties most used for gems, known as *precious* topaz, come chiefly from Brazil; but topaz is found in many other parts of the world — in Ceylon, the Ural Mountains, Siberia, Japan, Germany, Mexico, Colorado, Utah, California, and Maine. Topaz occurs in cavities and pegmatite veins in granite and

Topeka Chamber of Commerce

A BELOVED LANDMARK IN TOPEKA is the giant cottonwood tree which spreads its leafy branches beside the handsome capitol. The cottonwood, rising to a height of ninety feet, is the only tree on the State House grounds which grew naturally there.

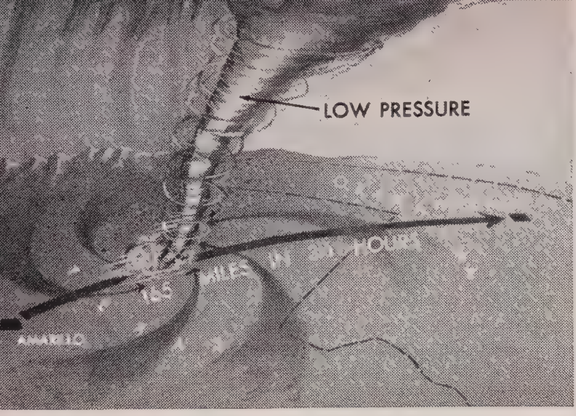
gneiss and also as pebbles in stream deposits. Chemically it is an aluminum silicate containing varying proportions of fluoride and hydroxyl (OH). On the Mohs scale of hardness topaz ranks 8, corundum 9, and diamond 10.

The term topaz is commonly but improperly applied to yellow varieties of other minerals. Thus yellow sapphire, or corundum, which is heavier and harder than topaz, is called *oriental topaz*; and yellow quartz, or citrine, lighter and less hard than topaz, is called *false, smoky,* or *Madeira* topaz.

TOPEKA, *toh pe'kuh,* Kan., the capital and third largest city of the state, is situated on the Kansas (or Kaw) River about sixty-five miles west of Kansas City. Topeka has been a gateway to the West since pioneer days; here the Santa Fe and Oregon Trails crossed, branching off to the southwest and northwest respectively. Today the city is on the line of four continental railroads. The city is served also by major airlines.

Its location, close to the geographical center of the nation, makes Topeka a natural transporation hub. Its growth and economic development owe much to its position between the Corn Belt and the Cattle Belt, within easy reach of the major fuels — coal, oil, and natural gas. Topeka is known not only for its great industries but also for its important Air Force installations and its famous centers of psychiatric treatment.

The city, rectangular in plan, is cut from north to south by Kansas Avenue, the main business street. Notable buildings are the state



A SECTION OF THE PATH of the terrible tornado that hurtled across three states is shown in this diagram.

capitol, built on the plan of the national Capitol, and decorated with murals by John Steuart Curry, and the Kansas Memorial Building, which houses the excellent museum of the State Historical Society. Washburn Municipal University, with its Mulvane Art Museum, provides higher education, and the Menninger Sanitarium and Menninger Foundation are outstanding centers of psychiatric work.

Representing business and industry are publishing houses and printing plants, iron and steel mills, flour mills, meat-packing plants, insurance offices, rubber-tire plants, and the central offices and huge building and repair shops of the Santa Fe Railway. Lake Shawnee and its wooded park area provide a charming recreation spot near the city.

Two French-Canadian brothers established a ferry on the site of Topeka in 1842. The town was founded in 1854 by a group of antislavery colonists led by Cyrus K. Holliday, who later organized the Santa Fe Railway. Topeka became the state capital when Kansas was admitted to the Union in 1861. The population is about 79,000.

TORNA′DO, a violent local windstorm in which whirling, uprushing winds may reach velocities of 200 to 500 miles an hour or more, often resulting in great destruction to life and property. In the United States, where these "twisters" are far more common than elsewhere, their average number is more than 125 a year. They have been reported in every state, but most frequently in the Missouri, Mississippi, and Ohio valleys, in the central plains states, and in the interiors of the Southern states. They are sometimes incorrectly called "cyclones," the name for a weather phenomenon on a much larger scale (see CYCLONE; WHIRLWIND).

Waterspouts are tornadoes over water. Though dangerous to ships in their paths, most waterspouts do less damage than many land tornadoes, even those over open country. Waterspouts have been seen over the Pacific Ocean off the Chinese and Japanese coasts, in the Gulf of Mexico, and off the coasts of the United States.

Formation and Effects. Tornadoes are most likely to occur in the spring and early summer, and in the late afternoon or warmer part of the day. They usually develop along squall lines, that is, in the regions where the approach of a large mass of cold air (cold front) is marked by thunderstorms and heavy rainfall. The characteristic dark, funnel-shaped tornado cloud descends from low swirling clouds. If the bottom of this whirling cloud, or vortex, comes close to the ground, there is a relatively narrow path, usually only 300 to 1,500 feet wide, along which its violent winds destroy crops, blow down trees and buildings, overturn and smash vehicles and other objects, and strew debris over great distances.

Atmospheric pressure at the center of the whirl is very low, giving the funnel a tremendous suction effect, often great enough to lift barns and houses from their foundations. The rapid drop of pressure that occurs as a tornado approaches may cause explosive effects; the greater pressure inside buildings forces their walls outward. Devastation along the path of a tornado may be interrupted occasionally whenever the lower end of the funnel cloud lifts well above the ground.

Tornadoes in the United States usually travel from southwest to northeast at twenty-five to forty miles an hour. Their winds swirl around the central vortex in a direction that, viewed from above, is counterclockwise, that is, opposite in direction to the motion of the hands of a clock. This is the same direction as the winds of a cyclone.

The life of a tornado is seldom more than two hours, and ordinarily much shorter. But one that swept along a 220-mile path through Texas, Oklahoma, and Kansas in April, 1947, lasted for five hours and caused property losses of nearly $10,000,000. This tornado, the largest on record, had a path almost two miles wide at Woodward, Okla. It damaged or destroyed 1,500 homes, injured 1,000 persons, and took some 170 lives. Property losses were more than twice as great in the St. Louis tornado of 1927; and injuries and lives lost were far more numerous in the Ohio Valley tornado of March, 1925. This was one occasion on which the funnel-shaped cloud was absent, perhaps because the clouds were too low.

Forecasting. Tornado warnings for limited regions had never been possible until new methods were developed about the middle of the twentieth century. One group of workers in Oklahoma, using electronic methods, found that lightning in a distant tornado could be distinguished from that in an ordinary thunderstorm. Another group found that tornadoes can always be expected in a

OVERLOOKING TORONTO'S HANDSOME LAKE FRONT are the Royal York, largest hotel in the British Commonwealth (left of center), and the Bank of Commerce, tallest building in the Commonwealth (right of center).

region which a cold front is approaching if, at the same time, a belt of high, dry air comes in from the west or southwest and blows strongly above and across a narrow tongue of moist air that is moving northward over the surface. Under these conditions the air is unstable and the approaching cold front apparently sets up in it the rapid up-and-down movements in which a tornado is born. By 1951 the United States Weather Bureau had established a close network of stations in Kansas and Oklahoma to use for investigating and improving these methods and for developing others that may be valuable in forecasting tornadoes.

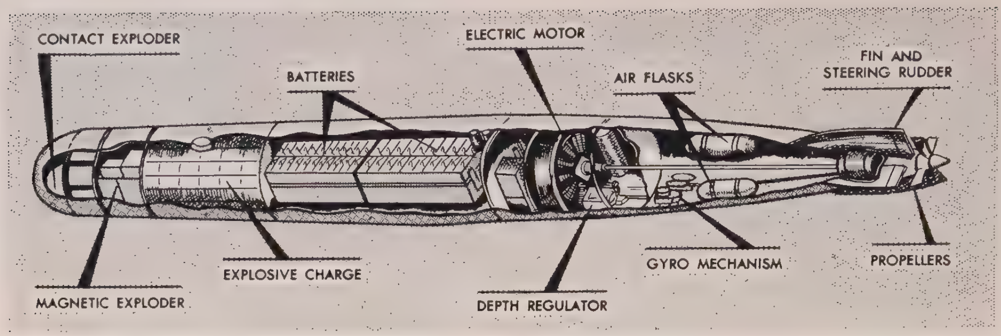
TORONTO, ONTARIO, is the provincial capital and one of the largest cities in Canada. It is a busy lake port and an important center of finance and industry. In size of population it is a rival of the French-speaking city of Montreal, in Quebec, but in many respects it ranks as the leading metropolis of the Dominion. It is a city of beautiful parks and stately buildings, of efficient industrial plants and crowded docks, and of vigorous progress coupled with calm stability.

Location and Industry. Toronto spreads for miles along the northern shore of Lake Ontario, near the western end. Across the lake to the south is the mouth of the Niagara River. The streets slope toward the harbor area, where excellent facilities are provided for Great Lakes shipping. Ships, railroads, and airlines connect the city with other parts of Canada and with the United States. Lake shipping affords a cheap means of transportation and Niagara Falls a cheap source of hydroelectric power for industry. Lumber, minerals, and other raw materials for industry are readily available to the north and west. The surrounding area, the most thickly populated in all Canada, furnishes a rich market for manufactured goods and also an abundance of farm produce to meet the needs of city dwellers. The prairie farmlands of the West are also a great market and source of supply.

The thousands of mills and factories operating in Toronto turn out a variety of products ranging from soap to ships, from wearing apparel to farm machinery. Wood products, rubber products, iron and steel products, and electrical apparatus are especially important. Among the leading industries are meat packing and publishing. Mail-order houses in Toronto serve the entire Dominion. The central offices of insurance companies and banking concerns and the great mining exchange are representative of the city's position as a financial center.

General Description. Toronto has many fine public buildings and hotels and is noted for its beautiful churches. The impressive Parliament buildings in Queen's Park are evidence of the city's status as the political center of Canada's richest province. Also imposing are the buildings of the University of Toronto, one of the great educational institutions of North America. In addition to its many institutions for higher learning, Toronto affords cultural advantages through its fine public libraries, the Royal Ontario Museum, an art gallery, two symphony orchestras, and the widely known Mendelssohn Choir. Each year a huge livestock show is held at the Royal Winter Fair, and even more famous is the Canadian National Exhibition, called the largest annual fair in the world. All winter long, hockey games between Canadian and American teams attract great throngs of sports enthusiasts. Not the least of Toronto's attractions are the beautiful drives that border the lake front and the many pleasant beaches both along the shore and on the small islands in the harbor area. Boating and fishing are popular diversions.

History. The region around what is now Toronto was visited by the French from the St. Lawrence area before 1700. French missionaries were active among the Indians there, and by the middle of the eighteenth century fur-trading centers and fortified army posts had been established. After the British conquered New France, as French Canada was called, British settlements grew up west of Montreal, and a separate province



A MODERN ELECTRIC TORPEDO like the one shown here can be equipped so that it will change its course to follow the sound of an enemy vessel's engines, tracking down its prey.

of Upper Canada was established. In 1794, John Graves Simcoe, governor of the new province, selected York as the capital, which in 1834 was renamed Toronto. The political rebellion which flared briefly in Upper Canada in 1837 was led by Toronto's mayor, William Lyon Mackenzie.

In the latter half of the nineteenth century the growth of Great Lakes shipping, the building of railroads and the resultant opening of the West, the development of industries, the harnessing of hydroelectric power, and the exploitation of mineral resources in the area, all contributed to the rise of this "Queen City" of Canada. The population is about 700,000. Within the metropolitan area of Greater Toronto there are over 900,000 people. See also MACKENZIE, WILLIAM LYON; ONTARIO.

TORPE'DO, a cigar-shaped, self-propelled, self-steered, underwater weapon that is used chiefly to destroy enemy ships by blowing holes in their hulls. It is the principal arm of the submarine, and it is used also by surface craft and airplanes. It is driven by twin propellers, which are turned either by a motor powered by storage batteries or by an engine driven by compressed air or steam, located within the steel hull of the torpedo. Electric torpedoes are slower than other kinds, but they do not produce the trail of escaping air or steam that sometimes enables vessels to dodge torpedoes and that betrays the position of the attacking submarine. They are also less erratic than the others, which strike their course only after much hunting and diving.

The torpedo is kept on its course, which is set before it is launched, by a gyroscopic device (see GYROSCOPE). The depth at which it is to run under the water is regulated by a device that reacts to the pressure of the water itself, which increases with depth (see HYDROSTATICS). From sea vessels, torpedoes are launched by compressed air; merely dropping them in the water from aircraft suffices to start their propellers turning.

For action, the torpedo is armed with a warhead containing TNT or some other explosive. The explosive may be set off either by a contact exploder when it strikes the target or by a magnetic device that is affected by the steel hull of a vessel (see FUSE). The magnetic exploder is designed to go off as the torpedo passes under the bottom of a warship, which, unlike the sides, is not armor-plated. For practice purposes the warhead is replaced by an exercise head filled with water or containing instruments that show such things as the torpedo's speed and the depth at which it traveled. Exercise torpedoes may be recovered for use over and over again.

Most of the torpedoes used in recent times by the United States Navy have been 21 feet long, 21 inches in diameter, and 1.5 tons in weight. Their warheads hold more than 600 pounds of TNT or TPX. They have a speed of more than 50 miles an hour for a distance of about 2.5 miles. They could travel much farther at slower speeds, but because of the risk of missing the target, slower speeds are seldom used.

David Bushnell, in the Revolutionary War, and later Robert Fulton experimented with underwater explosives, but these attempts were not effective. The first successful bomb of the torpedo type was used in naval operations in the War between the States. The first self-propelled torpedo was brought out by Robert Whitehead, English inventor, in 1866. An American naval officer, John Adams Howell, invented the gyroscopic steering torpedo in 1885. See also SUBMARINE.

TORPEDO, or **ELECTRIC RAY**. See RAY.

TORQUEMADA, *tawr kay mah'dah*, TOMÁS DE (1420-1498), a Dominican friar who was the head of the Inquisition in Spain, was born in Valladolid. He joined the Dominican Order, and while he was prior of a convent in Segovia he became the father confessor of Queen Isabella and King Ferdinand. He had great influence on the King and the Queen and persuaded them that the

Moors should be driven from Spain, the Jews converted or expelled from the country, and all heretics forced to recant or suffer punishment. As Grand Inquisitor, Torquemada was known for his bitter cruelty. His court condemned about two thousand persons to death as heretics. See also INQUISITION.

TOR′RENS SYSTEM, a system of registering titles to real estate, introduced in Australia in 1857 by Sir Robert Torrens. The Torrens system enables a property owner to obtain a certificate of ownership which protects him against any claims on the property by others, and it makes the transfer of the property from the owner to a new purchaser a simple, safe exchange.

Under the Torrens system, title to property is guaranteed by public authority; other systems make use of insurance companies and private guarantors. To obtain a Torrens title a property owner files a petition for registration with the registrar and accompanies it with all the records he has concerning the title to the property. An examiner of titles investigates the claim of ownership, and if it is satisfactory he issues a certificate of title. If the owner sells the property his certificate is canceled, and a new certificate is issued to the new owner.

Once a certificate of title is registered, it remains in force. Should any valid claim be made against the property it cannot affect the title, and the original owner will not have to pay it. Instead, the state pays the claim from a fund created for that purpose by charging a fee for registration. The title can be transferred again and again without the investigation and examination necessary at each transfer under older systems.

The Torrens system spread from Australia to other parts of the British Commonwealth, including most of the Canadian provinces. The system, or some similar method of registering and transferring titles, is used in many European nations. Illinois was the first of the American states to adopt the Torrens system, and today a number of states make use of it. See also DEED.

TORRICELLIAN, *tor ih chel′ih an,* **VACUUM**. See BAROMETER.

TORRID ZONE. See TROPICS.

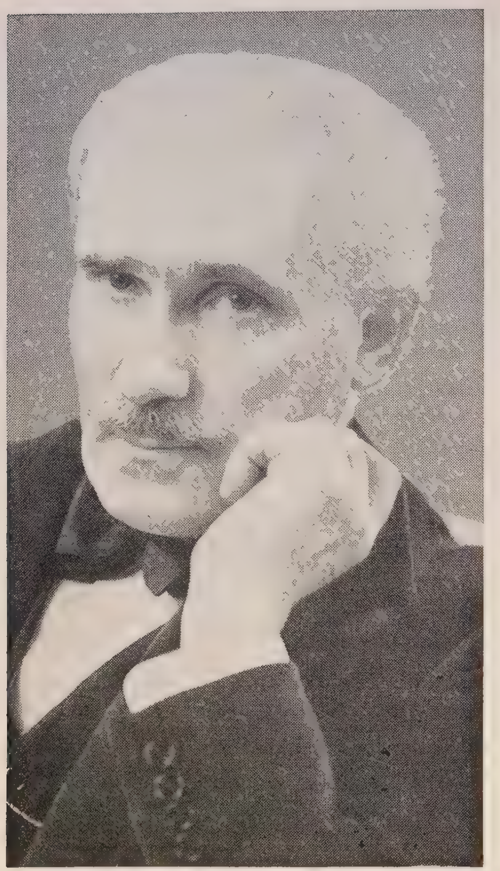
TORT, a civil wrong, or offense against an individual, for which the law requires payment, or damages, to the person wronged. Telling or publishing lies about a person and trespassing on or damaging his property are examples of torts. The same act may be both a tort and a crime. For example, a man may be prosecuted by the state for the crime of assault and battery and at the same time may have an action for damages brought against him by the person injured through this tort.

TORTOISE, *tawr′tus,* any of numerous species of land turtles, which usually are equipped with a highly arched upper shell and stout, unwebbed, elephantlike feet. Tortoises inhabit the dry areas of temperate and tropical zones throughout the world. Probably the best-known European tortoise is the *Greek* tortoise, a yellow and black species that is frequently kept as a pet. It is native to Asia Minor and the Mediterranean countries. Among the common American tortoises is the *gopher* tortoise of the southeastern United States. This yellowish-brown reptile seldom exceeds twelve inches in length and weighs between eight and ten pounds. By day it hides in one of the sandy burrows which it digs; by night it prowls about in search of edible vegetation. The almost extinct *giant* tortoises of the Galápagos Islands off South America and the Aldabra Islands in the Indian Ocean frequently attain a weight of almost five hundred pounds and may live to be over a hundred years old. Despite their size, they are docile in captivity. Sometimes the name tortoise is given to certain fresh-water turtles, such as the box turtles, or box tortoises. See also BOX TURTLE; TURTLE.

Scientific Names. Greek tortoise, *Testudo graeca;* gopher tortoise, *Gopherus polyphemus;* giant tortoise, *T. gigantea.*

TORTOISE SHELL, a product obtained from the horny shields covering the upper shell of the hawksbill turtle, is widely used in combs, eyeglass frames, jewelry, and many decorative articles. It is made by removing the thin, translucent, marbled yellow-and-brown shields, scraping and softening them in boiling water, and finally welding them together under pressure. After the shields have been welded together, the tortoise shell may be molded into various shapes by heat and pressure. It also can be polished to a high luster, which in shell of better quality may be retained almost indefinitely. Because it is expensive it is often imitated in stained horn or plastic, but genuine tortoise shell can be identified by the narrow lines indicating where the shields have been welded together. See also HAWKSBILL TURTLE.

TORY PARTY, BRITISH, a major political party in Great Britain, representing the traditional aristocratic and conservative point of view, was organized in 1679 during the reign of Charles II. It was broken up and reappeared as the Conservative party about the middle of the nineteenth century. The early Tories supported the ancient claim of the king to supreme authority and scorned religious tolerance, while the opposition party, the Whigs, stood for parliamentary government, a limited monarchy, and freedom of religion for Protestant sects. The Whigs tried to keep the Catholic Duke of York from suc-



NBC Photo

TINY IN STATURE, ARTURO TOSCANINI demanded perfect performances from his musicians, who not only admired his high standards but also feared his wild rages during rehearsals.

ceeding his brother on the throne. When this attempt failed, they worked to overthrow him. Some Tories joined the Whigs in the Revolution of 1688, which established Parliament as the central authority of the government, deposed James II, and brought William and Mary to the throne. The Whigs were generally in power until 1760, after which the Tories held office for about fifty years. Local government was generally in Tory hands, for the Whigs had their largest following in the cities and towns. The Tory party was split by the question of reform early in the nineteenth century, and some members broke away. The Conservative party, which emerged from the ruins of the old Tory organization, is still called Tory at times (see CONSERVATIVE PARTY, BRITISH). The name, which comes from an Irish term for *bandit* or *robber,* was originally used in English politics by the Whigs, who employed it as a term of insult.

During the American Revolution those colonists who remained loyal to the British Crown were frequently called Tories, although Loyalist was a more exact term.

TOSCANINI, *tos kuh ne'nih,* ARTURO (1867-), one of the greatest of modern conductors, was born in Parma, Italy. He began his musical career as a cellist and made his debut as a conductor at the age of nineteen in Rio de Janeiro, when he was suddenly called on to take the place of the regular conductor during a performance of *Aïda.* He returned to Italy to conduct in many different cities, and in 1898 he was appointed conductor at Milan's famous La Scala, which under his baton had fifteen of its most brilliant years (1898-1903; 1906-8; 1921-29). During his long career Toscanini performed in almost every musical center, but he never used his talents in behalf of Fascism or Nazism. He conducted at the Metropolitan Opera in New York from 1908 to 1915, and in 1928 assumed the leadership of the New York Philharmonic Symphony Orchestra. When the National Broadcasting Company organized its own orchestra in 1937, he became its conductor. A tremendous audience listened to his broadcast concerts.

A natural musician and a perfectionist in even the smallest details, Toscanini could bring out the musical qualities of any composition in the fullest possible measure. He regarded himself merely as the agent of the music and strove to do absolute justice to the composer's intentions. As an interpreter of the music of Verdi, Schubert, Beethoven, and Wagner he was without a peer.

TO'TEM, the white man's version of an Algonquian Indian word signifying some animal, plant, or legendary being that has a special, mystic relationship to a human group. The totem, however, is not restricted to Indian culture. Some Australian tribes consider the totem to be the ancestor of a clan. Clan members pay ceremonial honor to their totem, which is strictly taboo as food. Some American Indians thought of the totem as a patron of a clan, not its ancestor. In most cases the totem was considered full of magic power and therefore dangerous unless it was handled with great ceremony.

The Tlingit, Tsimshian, and Haida Indians of southeastern Alaska and British Columbia thought that certain animals had been the patrons and helpers of prominent families, and after these Indians had acquired tools from the white men, they developed family *totem poles,* on which they carved images of all the supernatural beings associated with a family. At first these heraldic devices were carved on the corner posts inside the house. Then they were moved to the doorposts, and finally were set up separately at some distance from the dwelling. The finest totem poles, on which the figures are closely intertwined, one on top of another, were produced during the last half of the nineteenth century.

TOUCAN, *too kahn′*, a family of brilliantly colored birds with huge, thin-shelled beaks. They are related to the woodpeckers, and about sixty species are found in the tropical regions of the Western Hemisphere. Their plumage is mainly red, yellow, and black. The great bill, deep at the base and curving downward at the tip, has notched edges. It is about as long as the bird's tail, and it is often highly colored. Toucans live mainly on tropical fruits and occasional insects. Like the parrots, which they resemble in some ways, they lay their eggs in a hollow tree.

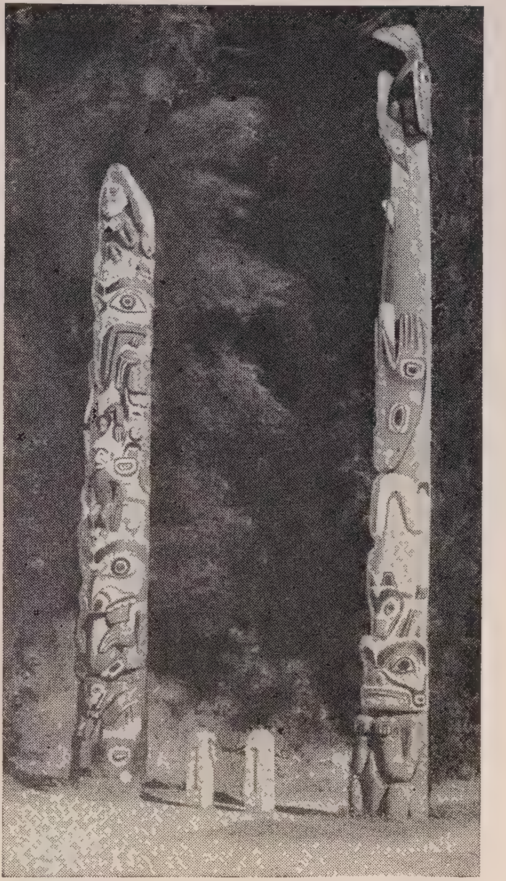
Scientific Name. Common toucan, *Ramphastos toco.*

TOUCH, the sensation which tells us that an object of some kind is in contact with the skin. The sense of touch is made possible by certain small organs located beneath the surface of the skin. These organs, called *tactile corpuscles,* are scattered irregularly over the body. When they are stimulated, as by an object pressing against them, they send a message by way of the nerves to the brain, where we are instantly made aware of the contact between the object and our skin.

The delicacy of the sense of touch in a particular part of the body depends upon the number of tactile corpuscles in that part. The more tactile corpuscles, the better developed the sense of touch. On the back there are comparatively few touch organs and the sense of touch is not well developed. The tip of the tongue and the finger tips, on the other hand, have a great many tactile corpuscles and therefore are very sensitive. When we handle an object with our fingers, we not only know that the object is in contact with our skin but also learn its shape, hardness, and perhaps its texture. In addition, other sense organs, similar to the tactile corpuscles, tell us whether the object is hot or cold and whether it causes pain.

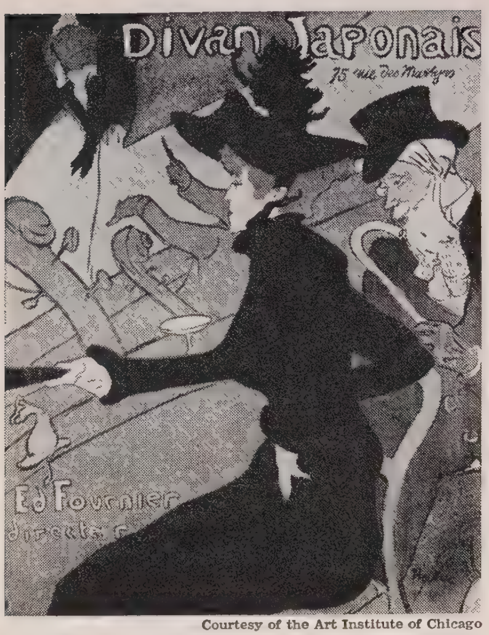
Blind and deaf persons learn to depend very heavily upon the sense of touch, and as a result this sense becomes highly trained. Even in normal persons there is a good deal of variation in the development of the sense of touch. In some it may be almost as acute as in a person who is blind; in others it may be poor. The sense of touch in any part of the body may be lost through disease, such as paralysis, or temporarily through local anesthesia.

TOULON, *too lawn′*, FRANCE, a city on the Mediterranean coast about thirty miles east of Marseilles, is second only to Brest as a naval base and arsenal of the French Navy. It has a fine, heavily fortified harbor. The principal industries are connected with shipbuilding, but in the region around the city, truck farming is highly developed, and there is trade in wine, grains, soap, and fruit. Toulon was founded even before Roman times, and it was made a naval station in the seventeenth century. The city suffered heavy bombardment during World War II, and in November, 1942, the French naval authorities scuttled many of the ships that had been interned there rather than let them fall into the hands of the Germans. The population is about 126,000.


Burlington Route Photo

TOTEM POLES OF RED CEDAR, carved by Tlingit and Haida Indians, are the center of interest at Sitka National Monument in Alaska.

TOULOUSE, *too looz′*, FRANCE, a city on the Garonne River about 440 miles south of Paris, is the capital of the Haute-Garonne department and the hub of a rail and canal system serving all southwestern France. The city handles the grain, wine, cattle, and garden produce of this rich agricultural region. Chemicals, shoes, tobacco, and farm machinery are manufactured. Toulouse, a city built chiefly of red sandstone, has a



Courtesy of the Art Institute of Chicago

POSTERS BY TOULOUSE-LAUTREC, advertising the amusement places of Paris, now appear in art museums and galleries in many lands.

number of fine old churches, among them the eleventh-century Romanesque basilica of St. Sernin. The university, founded in 1230, is one of the oldest and largest of the provincial universities. The Academy of the Floral Games, a society dating from 1324, in the days of the troubadours, still awards annual prizes for poetry. The city was founded in pre-Roman times, and after the fall of Rome it was the capital of the Visigoth kingdom and, later, of the province of Languedoc. It reverted to the French crown after the religious wars of the thirteenth century. The population is about 264,000.

TOULOUSE-LAUTREC, *too looz′loh trek′,* in full Henri Marie Raymond de Toulouse-Lautrec Monfa (1864-1901), French illustrator and painter, born in Albi. Following early studies, he settled in the colorful Montmartre section of Paris and sketched scenes of the music halls and café life in a bitterly realistic style. He was a leader of the unconventional Bohemian set. His keen observation of human nature found expression in posters, illustrations, lithographs, and oil paintings. Despite the handicap of physical deformity and frequent lapses into dissipation, he produced works distinguished for economy, powerful draftsmanship, and a keen sense of abstract design. Many reveal the influence of Degas and of Japanese prints. Among his notable paintings are "At the Moulin Rouge," "Scène de Ballet," and "At the Cirque Fernando," which hang in the Art Institute of Chicago.

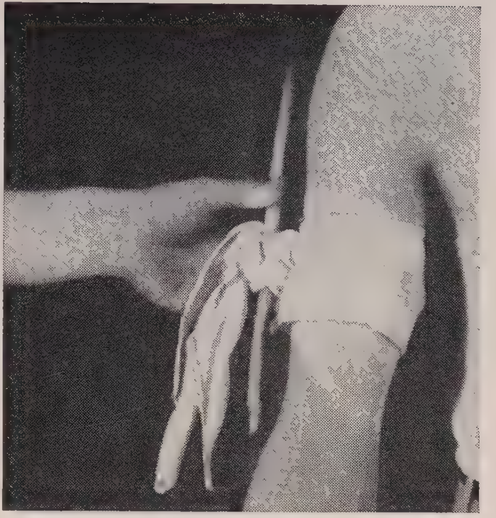
TOURMALINE, *toor′muh lin,* a hard mineral which is popular as a gem stone and useful in scientific work. It consists chiefly of boron and aluminum silicates (see Silicon), but other elements are also present in tourmaline, which therefore has a variety of colors. The rarest forms are the clear and transparent gem stones. Fine red, green, and blue specimens from Brazil are known by the trade names of *Brazilian ruby, emerald,* and *sapphire,* respectively. Tourmaline, which occurs in coarse granite, limestone, gneiss, and schist, is also found in Maine, California, Connecticut, and other American states, in Ontario, Canada, and in other parts of the world. Tourmaline crystals are prisms with three faces, or a multiple of three, often marked with lengthwise lines or grooves called *striations.* The crystals have interesting electrical and optical properties; the colored ones, for example, can produce plane polarized light by absorbing all light waves except those vibrating in one direction. See also Crystals and Crystallization.

TOURNAMENT, *toor′nuh ment,* or **TOURNEY,** *toor′nih,* a formal contest of skill at arms between groups of knights. The early tournaments, which probably originated in France, were very much like real battles and served to train knights in the art of warfare. The place of combat, called the *lists,* was a large, open space, usually with galleries for the spectators. A contest between two knights was called a *joust,* and there were usually a number of jousts before the tournament proper began. The two combatants rode at each other with lances set, and each tried to unhorse his opponent. Men who were unhorsed fought on foot with swords, daggers, or clubs. Groups of knights took part in the tournament. Each faction wore a distinctive emblem or livery, and the fighting went on until the judges awarded the victory to one side or the other. These tournaments were hardly less dangerous than real battles, and many men were killed or wounded. When armor was perfected and new rules for tournament fighting were laid down, fewer knights were killed in the lists, and the tournament became the occasion for great display and pageantry. Kings and great nobles sponsored tournaments in celebration of some important event, and noble knights from many parts of Europe attended. Costumes, armor, pennons, banners, and elaborate heraldic devices added to the pomp and ceremony of the occasion. However, even in the sixteenth century, casualties occurred. Henry II of France lost his life in a tournament in 1559.

TOURNIQUET, *toor′nih ket,* a device for stopping the flow of blood in a limb or some other part of the body. In an emergency a simple kind of tourniquet can be made by wrapping a flat band of cloth at least two inches wide around the limb, passing a short stick under the cloth, and then twisting the stick until enough pressure is exerted on the blood vessels to cut off circulation. The more elaborate tourniquets consist of various screw and pad devices or of rubber tubes which are distended by means of air pumps. A tourniquet should be used only when bleeding cannot be checked by other means. It should be loosened every fifteen or twenty minutes, for if the circulation is cut off too long, the tissues die and gangrene may then develop.

TOURS, *toor,* FRANCE, a city on the Loire River about 145 miles southwest of Paris, is the capital of the Indre-et-Loire department and the chief city of Touraine, a former province noted for its smiling landscapes, its beautiful chateaux, and the purity of its spoken French. Tours is a handsome city, with wide boulevards and fine bridges. The Gothic cathedral, dedicated to St. Gatien, was begun in 1170. Tours provides a market for the wine and other agricultural products of the region, and its industries include silk weaving, printing, the manufacture of stained glass, and some work in metals. The history of the city goes back to pre-Roman times; by the fourth century Tours was known as a center of religion and learning. In 732 the invading Saracens were met near Tours by Charles Martel, leader of the Franks, and defeated in one of the decisive battles of the world (see CHARLES MARTEL). The population is about 80,000.

TOUSSAINT L'OUVERTURE, *too saN′-loo vehr tyoor,′* PIERRE DOMINIQUE (1743-1803), a patriot soldier and liberator of Haiti, was born near Cape François, the son of Negro slave parents. He learned to read and write and became a leader of the slaves in their fight for freedom. He played an important part in a short-lived revolt in 1791, and in 1793 the Revolutionary government of France granted liberty to the Haitian Negroes. Toussaint was appointed head of the troops in Haiti and fought for the French against the English. In 1799 the freed Negroes drew up a constitution and elected Toussaint president of the country for life. His brief administration was wise and generous, but in 1802 Napoleon, fearing that the Haitians were about to declare their independence, sent an expedition against the island. Toussaint was taken to France as a prisoner and held without trial until his death.



IN A SERIOUS EMERGENCY, a tourniquet made of a stick and a strip of cloth can be used as shown here to stop bleeding of the lower arm.

TOWER, a tall structure in which the height is much greater than the width or thickness. There are many kinds: church towers that serve the practical purpose of housing the bells and the artistic purpose of adding balance and proportion to the architectural plan; minarets; clock towers that lend strength and dignity to the design of public buildings; watchtowers and keeps of medieval castles; ancient strongholds built for protection against bands of marauding raiders; lighthouses; the towers of modern skyscrapers; and some public monuments.

Some church towers, like Giotto's campanile in Florence and the Leaning Tower of Pisa, are freestanding; others form part of the church itself. During the Middle Ages many Italian cities were studded with high, narrow towers built by noble families as refuges in time of private feuds or civil war. There were at least two hundred in Bologna, and probably more in Florence and Pisa.

During the centuries when the Vikings were sea rovers and raiders, the Irish and the Scots built round stone towers as watchtowers and places of refuge from the Scandinavian marauders. These towers were from 20 to 30 feet in diameter and from 60 to 130 feet high. To make it difficult for the enemy to force an entry, the doors were set high above the ground and reached by ladders that could be pulled up. Almost a hundred of these towers, some of them probably dating from the ninth century, are still in existence. See also CAMPANILE; EIFFEL TOWER; PISA, LEANING TOWER OF; TOWER OF LONDON.

TOWER OF LONDON, an ancient fortress and prison on the north bank of the Thames, in London's East Side. The central keep, called the White Tower, was erected in 1078 by William the Conqueror on the site of a fortress built by Julius Caesar.

Later English kings added other towers, walls, dungeons, a chapel, and an armory, encircling the whole with a great moat. Including the moat, which is now used as a parade ground, the fortress covers about eighteen acres. In addition to its celebrated prison, the Tower has housed a mint, royal living quarters, and judicial courts with authority to try dukes, princes, and even kings and queens. Through the great Traitor's Gate, Queen Anne Boleyn, Queen Catherine Howard, Lady Jane Grey, Mary, Queen of Scots, the Duke of Monmouth, and the Duke of Northumberland walked to their death. One of the most infamous deeds associated with the Tower was the murder (1483) of the twelve-year-old king, Edward V, and his small brother, Richard, Duke of York, by command of their uncle, Richard of Gloucester, in that section known as the Bloody Tower. Today the Tower functions chiefly as a museum for the preservation of collections of arms and invaluable royal insignia and jewels.

TOWERS OF SILENCE, large, circular stone structures on top of which the Parsees of India have long been accustomed to place the bodies of their dead, to be devoured by vultures and other birds of prey. The Parsees are the descendants of the Persian followers of Zoroaster who fled from their country in the seventh and eighth centuries because they feared persecution by the Moslems. The towers range in height from twenty to forty feet, and vary in outside circumference between 200 and 270 feet. Bodies are exposed on them to birds of prey so that the earth will not be defiled by decaying flesh. When the bones have been picked clean of flesh, they fall through a grating into a pit below. The practice of burial, however, is gradually replacing the use of the towers of silence among the Parsees. See also PARSEES; ZOROASTER.

TOWHEE, *toh hee′*, or **CHEWINK**, *chee-wingk′*, any of several birds belonging to the finch family. The *red-eyed* towhee is common in the eastern United States and southern Canada. The male has a black head, chest, and back, with broad bands of reddish chestnut on the flanks. The under parts and wing tips are white, and in flight the towhee shows a band of white on each side of its long tail. The female's markings are similar, but the black of the male is replaced by a rich brown. The towhee likes low, thick shrubbery or open woodland, where it rummages vigorously among the leaves, searching for insects and seeds. The nest is usually on the ground or in a low shrub. The bird's common names refer to its call, a brisk *chee-wink′* or *tow-hee′*.

Scientific Name. Red-eyed towhee, *Pipilo erythrophthalmus*.

TOWN MEETING, an assembly of the citizens of a town or township. In the villages of early New England the people met together frequently to take care of town business. In time, as the villages grew into towns and cities, the administration of the town government was put into the hands of elected officials called *selectmen*, and the town meeting became an annual instead of a weekly or a monthly affair. The town-meeting system of government is still popular in New England and in some other parts of the United States. It is probably the best example of pure democracy, but it is not practical in cities because such meetings in thickly populated centers would be unwieldy.

TOWNSHIP, a district set aside as a minor unit of local government. In Canada it is a subdivision of a province, in Australia, a village, and in the United States, a division of a county, which varies widely as to organization and function. In New England, New York, New Jersey, and Pennsylvania, these districts are called *towns* and derive their authority from annual town meetings. But in states of the Middle West and several other states they are known as townships. Although these units of government cover all or part of the area of twenty-three states, they are of little importance or do not exist in the South and Far West.

A township may be completely rural or may include one or more towns or cities. If the county is regularly formed, the township is usually six miles square and consists of thirty-six sections of one square mile each. Township affairs usually are handled by an elected supervisor, trustee, or commissioner, or by a board of similarly named officers, together with a number of others. Among these may be a clerk, treasurer, assessor, constables, justices of the peace, highway overseer, and various advisory boards.

TOXIN, *tok′sin*, any of the poisonous substances produced by certain living animals and plants. Examples include ricin from the castor-oil bean, the venom of poisonous snakes and spiders, and bacterial toxins, such as those produced by the diphtheria bacillus, scarlet-fever streptococcus, and tetanus (lockjaw) bacillus. When introduced into the body, toxins bring about the formation of antitoxins which neutralize the poisons. Toxins produce symptoms only after an incubation period and in many cases cause illness or death by acting on specific tissues. See also IMMUNITY.

TOYNBEE, *toin′bee*, ARNOLD (1852-1883), English economist, historian, and reformer, was educated at Oxford and lectured there from 1878 to 1883. His particular field was upheaval of society caused by the introduction of the machine as a means of production, and he gave the name "industrial revolution"

Caterpillar Tractor Co.; Miller Studio

GROUND-GRIPPING POWER characterizes both the mighty Caterpillar diesel tractor, hauling a combine through a hillside wheat field, and the light tractor, being used as a cultivator.

to this period of change. He was deeply interested in the human problems created by the spread of industry and the growth of cities, and he supported trade unions, co-operatives, and other organizations attempting to improve conditions of living for the working people. After Toynbee's early death, his friends established Toynbee Hall, one of the first social settlements, in the East End slum district of London. See also Industrial Revolution; Social Settlements.

TOYNBEE, Arnold Joseph (1889-), English historian and specialist in international affairs, nephew of Arnold Toynbee (see above), was born in London. He was educated at Oxford and taught there from 1912 to 1915. During World War I he served in a branch of the Foreign Office, and from 1919 to 1924 he was professor of Modern Greek and Byzantine Studies at the University of London. In 1924 he became head of the Royal Institute of International Affairs, and during World War II he again served in the Foreign Office. His monumental *Study of History,* which made his popular reputation, was projected as a series of nine volumes. Three appeared in 1933 and three more in 1939. An abridged edition of these first six volumes was published in 1946. In this study Toynbee analyzed the living and the dead civilizations of the world in an attempt to discover the reasons for their rise and fall.

TRACHEA, *tra'kee uh,* or **WINDPIPE**, a hollow, tubelike organ of man and other vertebrates. It is about four inches long and three fourths of an inch in diameter and extends downward from the larynx to the upper part of the chest. There it forks to form the right and left bronchi. The trachea is the main channel for the intake and outlet of air. It has a mucous membrane lining covered with tiny hairlike *cilia;* these cilia are constantly in motion and help to keep dust and other foreign particles out of the lungs by sweeping the particles up into the pharynx. The outer wall of the trachea consists of firm, fibrous tissue supported and protected by a number of open rings of hard cartilage. If the trachea becomes blocked, as it may in severe respiratory disease, choking and death may result. The blockage may be relieved by an operation known as a *tracheotomy,* in which a tube is inserted into the trachea to form an artificial opening.

TRACHOMA, *truh ko'muh.* See Conjunctivitis.

TRACK AND FIELD. See Athletics.

TRACTAR′IANISM. See Oxford Movement.

TRACTOR, a self-propelled vehicle using petroleum fuels and designed to move or operate farm or other vehicles and machinery. Gasoline tractors were made experimentally in the 1890's, and their commercial production followed in the next decade. They came into extensive use on American farms during World War I and now are the chief source of farm power. They are also of major importance in road construction and similar heavy work.

Early tractors had one or two cylinders, but the present trend is toward four- and six-cylinder engines. Ordinarily, kerosene and diesel oil are used as fuel, in addition to gasoline. The track type of tractor, which runs on an endless metal belt, is popular for logging, earth removal, and for farm work on the Great Plains, but it is not used where row crops must be cultivated. Of wheeled tractors, the high-axle, general-purpose tractor is most used on farms, since it is more suitable for cultivation than the standard, low-axle tractor. General-purpose tractors are built so that cultivators and other farm machines can be mounted directly on the tractor frame. On earlier tractors, removable steel lugs were used to increase the traction of the wheels, but these have been superseded by rubber tires, which not only give superior hauling power but also reduce wear and tear on the tractor and its operator. (See preceding page.)

TRADE. See Commerce; International Trade.

TRADE ACCEPTANCE, in business dealings, a commercial paper which the buyer of merchandise receives from the seller, signs, and returns, thereby giving his promise to pay for the goods at a certain time and place. In business deals in which goods are bought and sold the trade acceptance usually takes the place of the promissory note, which it practically becomes once it has been signed and thus "accepted" (see Promissory Note). The trade acceptance is an instrument of credit which the seller can use at his bank (see Credit).

Here is an example of the use of a trade acceptance. The Smith Company of Boston sells to the Hardy Company of Chicago a bill of merchandise amounting to $2,500. The Smith Company sends the time draft (see Draft) with the trade acceptance to the Hardy Company. The Hardy Company signs the trade acceptance and returns it to the Smith Company. The Smith Company may hold the trade acceptance until the time when payment is due or it may prefer to discount the paper at a bank (see Banks and Banking; Discount). The bank will immediately credit the Smith Company with slightly less than $2,500 and at the designated time will collect the full amount from the Hardy Company.

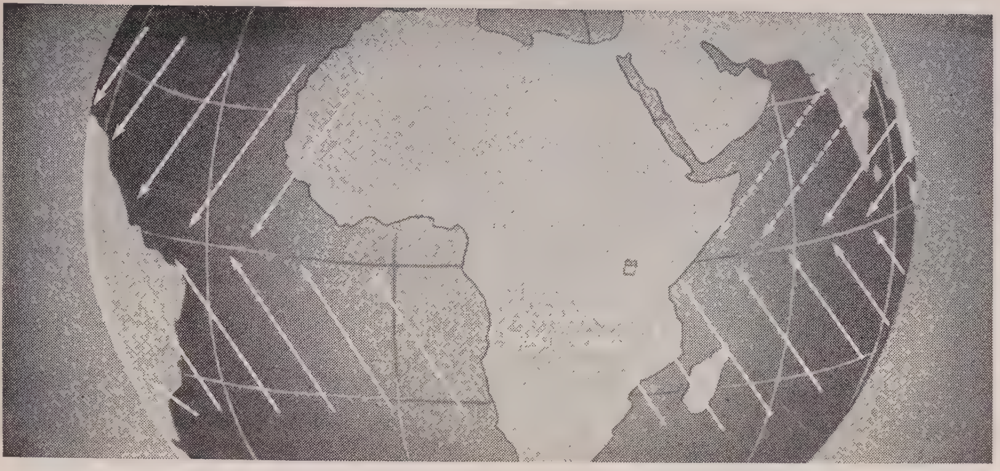
TRADE DISCOUNT. See Discount.

TRADEMARK, a word, name, picture, or other device used by a manufacturer to identify his product and to distinguish it from the product of any other manufacturer. Special marks were used for this purpose in ancient Rome and in the Middle Ages. Symbols were especially useful at a time when most people could not read, and even today pictures of bearded men, newly hatched chickens, and flying red horses on packages, cans, and signs identify products for millions of buyers. Such familiar pictures, as well as names, initials, and other markings, are looked for by these buyers in making their purchases, and therefore every manufacturer wants to be sure that the marking he uses is his alone. Since the late 1800's, trademarks have been regulated by laws in many lands, and the owner of a trademark has a legal right to stop anyone else from using his mark.

In the United States, manufacturers pay a fee to register their trademarks at the Patent Office, and their trademarks appear on their products with the notation "Reg. U.S. Pat. Off." The government then gives them, and them alone, the right to use their particular trademarks for a period of twenty years, and after that time they may renew their registration. Other countries have similar laws protecting trademarks and similar systems for registering them for various periods of time. Most countries have joined in international trademark conventions or treaties which give full protection to the trademarks of their citizens in all the other nations taking part. See also Advertising.

TRADES UNION CONGRESS, the national federation of labor unions of Great Britain, was organized in 1868. The Trades Union Congress is the representative of nearly 190 labor unions, but each union acts independently. The TUC is governed by annual congresses which determine the general policies; between meetings it is directed by a general council elected by groupings of unions. The Labor party was created by the TUC as its political arm; the party is now an independent organization, but in practice it is dominated by the federation, and most of its members are from the labor unions. Of the nine million trade-union members in Great Britain, nearly eight million are affiliated with the Trades Union Congress. See also Great Britain.

TRADE WINDS, the steady winds that blow toward the equator in two belts that extend from latitudes of about 30° north and south to within a few degrees of the equator. North of the equator the prevailing direction



ALLY OF THE MERCHANT AND EXPLORER, the trade winds aided commerce and discovery in the days of sailing ships. The dotted lines indicate that the winds in this area reverse their direction during part of each year.

of these winds is from the northeast, and south of it, from the southeast. They are therefore called the northeast and the southeast trades. Especially over the oceans the trades are the most regular in force and direction of all the earth's winds, blowing usually from six to fifteen miles an hour.

Since the trades are also regions of fine weather and few storms they were tremendously important to ocean-borne commerce in the days of sail. The name for these winds does not come, however, from their help to trade, but from old German and Saxon words that mean a *steady track* or *course*. Whenever possible, sailing vessels kept in the path of the trades. Such a route was shorter in days, even though longer in miles, than a more direct route. Between the two trade-wind belts lies a narrow region, called the *doldrums*, which sailing vessels avoided if possible. The weather there is often stormy, the winds are light and variable, and there are frequent calms during which the wind does not blow for days at a time.

The trade winds are not as constant over the continents and near them as they are over the oceans, especially in the warm seasons. Local winds and seasonal ones may be much stronger. The summer monsoons of Asia, for example, blow onto that continent from the southwest, south, and southeast, even though this region is in the belt of the northeast trades (see MONSOON).

All surface winds blow from regions where the atmospheric pressure is high toward regions where it is low. The trades blow from a region of more or less permanent high pressure in the horse latitudes, at about 30°, toward a region of low pressure near the equator. One might expect, therefore, that the trades would blow directly from the north and from the south in the two hemispheres. But the rotation of the earth deflects winds to the right in the Northern Hemisphere, making the trades there blow from the northeast. In the Southern Hemisphere the trades are deflected to the left, and hence blow from the southeast.

Climatic Effects. As the trade winds move toward the equator they are increasingly warmed and can therefore hold increasingly large amounts of water vapor that has been evaporated from the oceans and from lakes, rivers, and vegetation on land (see EVAPORATION; HUMIDITY). When the trades reach mountains on the eastern, or windward, side of an island or a continent, they hold a great deal of water vapor. As the winds are forced upward by the mountains they are rapidly cooled and lose some of their ability to hold water. They are thus forced to give up much of their moisture as heavy rainfall. Over the oceans in the trade-wind belt there is little rainfall except near the equator and near the western shores of the oceans, where tropical hurricanes occur (see HURRICANE).

When the warmed trades blow over low-lying lands they absorb water greedily. This is especially so for lands to the west, or leeward, of mountains where the trades have lost moisture. Trades blowing over land are consequently drying winds, or desert makers. The Sahara and several other large deserts lie in the trade-wind belts (see DESERT). See also WIND.

TRAFALGAR, *truh fal'gur*, BATTLE OF, a great sea battle in which an English fleet of twenty-seven ships under the command of Lord Nelson utterly defeated a combined fleet of thirty-three French and Spanish vessels. It was fought off Cape Trafalgar on the Atlantic coast of Spain on October 21, 1805. Admiral Villeneuve, the French commander, lost twenty ships. Nelson lost none, but he himself was fatally wounded in the battle. The British victory at Trafalgar ended Napoleon's hopes of invading England and left Britain master of the seas. See also NELSON, HORATIO.

TRAGEDY, *traj'eh dih,* a play about human suffering and conflict, which ends with the death of the central character or the destruction of all his hopes, and which nevertheless exalts the spirit of man. Aristotle said that tragedy must "arouse pity and awe, and a sense of emotion purged and purified thereby." Tragedy developed from the ceremonies of the Greek religious festivals in honor of Dionysus, and by the fifth century B.C. it had become a magnificent art form. It reached great heights in the work of three tragic poets, Aeschylus, Sophocles, and Euripides, in classical Greece, and again in Elizabethan England, with Shakespeare's masterpieces.

If a tragedy is to achieve the essential emotional depth and create a feeling of exaltation in spite of its somber theme, the struggle and its outcome must be significant enough to stir the minds and hearts of men; the characters must be capable of suffering; and the language of the play must be equal to its theme. In the plays of the Greek poets, the Elizabethans, the French writers Corneille and Racine, the German Goethe, and other authors of tragedy, the heroes and heroines are kings, queens, or noble warriors. Modern authors find tragic conflicts in ordinary life and tragic heroes at any level of society. See also DRAMA.

TRAILING ARBUTUS. See ARBUTUS.

TRA'JAN, in full, MARCUS ULPIUS TRAJANUS (about 53-117), Roman general and emperor, was born in Spain. His father was a distinguished Roman officer, and Trajan proved to be a brilliant military leader. He fought in Spain, Germany, and Syria and was named consul in 91 and governor of Upper Germany in 97. Emperor Nerva adopted him in 97, thus designating him as the successor to the throne, and on Nerva's death, early in 98, Trajan became emperor. He was an able administrator, who reduced taxes, instituted a program of public works such as the building of baths, roads, bridges, and the Forum of Trajan in Rome, and improved the organization of the provinces. He led two campaigns against the Dacians on the lower Danube, in 101-2 and 105-7, and made captured Dacia (now Rumania) a Roman province. In 113 Trajan undertook an expedition into Asia Minor, because the Parthians, whose kingdom was in the valley of the Tigris and the Euphrates, threatened the eastern boundary of the Roman Empire. He succeeded in taking the Parthian capital and subduing the country briefly, but revolts soon broke out. Trajan died on the return journey to Rome and was succeeded by Hadrian. See ROME, HISTORY OF.

Trajan's Column, which stands in the Forum of Trajan in Rome, was erected by order of the Roman Senate in honor of the Emperor's military victories. It is a marble column eighty-eight feet high, decorated with a long, spiral relief picturing the Dacian Wars.

The Arch of Trajan, erected in 115 at Benevento, a town east of Naples on the ancient Appian Way, is another memorial to the greatly revered Emperor. It is one of the finest examples of the Roman triumphal arch.

TRANCE, any abnormal sleeplike condition. Sleepwalkers, persons under deep hypnosis, persons carried away by religious experience, mediums in a spiritualist seance, and mental patients in a stupor may all be said to be in a trance. During all trances, the person is completely or at least partly indifferent to what goes on around him, though he may be able to move about, speak, write, answer questions, or perform similar acts. In most cases he remembers little or nothing about the trance once it is over. Originally the term trance meant that the soul had temporarily become separated from the body. See also HYPNOTISM; SPIRITUALISM; SOMNAMBULISM.

TRANSCENDENTALISM, *tran sen den'tal iz'm,* a system of philosophy taught by some of the foremost New England thinkers and writers about the middle of the nineteenth century. The beliefs of the Transcendentalists are hard to define, since they had no fixed creed. Their leading idea was the supremacy of mind over matter, and they maintained that the truth of religion did not depend on tradition or historical facts, but that it always had an unerring witness in the soul. They believed that every person born into the world was possessed of a faculty which enabled him to perceive spiritual truth when this truth was clearly presented. A Transcendental club was founded by George Ripley in 1836, and the school was the outgrowth of this movement. Among the most eminent Transcendentalists were Ralph Waldo Emerson, James Freeman Clarke, Bronson Alcott, Theodore Parker, and Margaret Fuller.

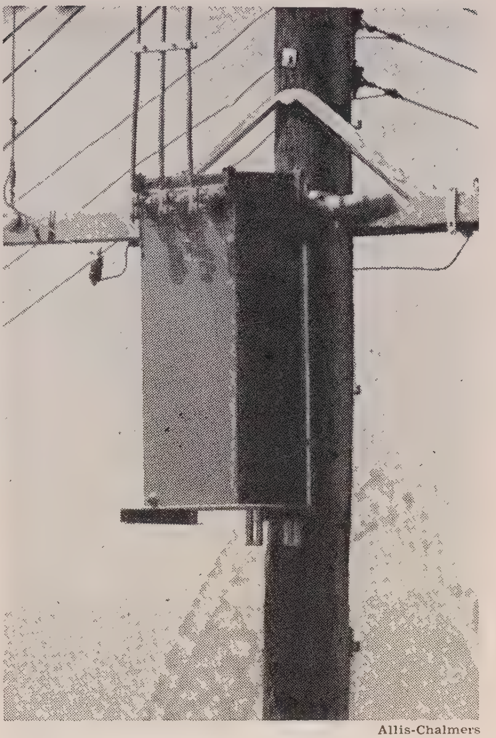
American Transcendentalism was not an original movement in philosophy, but rather an outgrowth and popularization of German Idealism. Nearly all of its distinctive tenets derived from such thinkers as Kant (whose system is sometimes taught as the "transcendental philosophy"), Fichte, Schelling, and Hegel. On the other hand, the influence of Transcendentalist ideas on present-day liberal Protestantism and religious "modernism," Unitarianism, and even Christian Science has been considerable. See also FICHTE, JOHANN; HEGEL, GEORG; IDEALISM; KANT, IMMANUEL.

TRAN'SEPT. Many cathedrals and churches are built in the form of a cross with the nave, or main body of the church, forming the long, vertical part of the cross. The spaces corresponding to the arms of the cross are called the transepts. They form right angles with the main aisle of the church and sometimes — not always — project beyond the side aisles, making the cross formation very apparent. See also CATHEDRAL.

TRANSFIGURATION, *trans fig yu ra'shun,* the supernatural change in the appearance of Jesus, probably on Mount Hermon, indicating His divine mission. Jesus took His three closest disciples, Peter, James, and John, and led them up a high mountain, and there "His face did shine as the sun, and His raiment was white as the light." Then Moses and Elijah appeared and talked with Jesus. The vision ended after the voice of God was heard glorifying His Son. This event was a means of preparing Jesus and His disciples for the testings and trials awaiting them. The story is told in Matthew 17:1-9, Mark 9:2-9, and Luke 9:28-36.

TRANSFORMER, a device for producing changes in the electrical pressure, or voltage, in different parts of the system by which alternating-current electricity is carried to the user from the power plant where it is generated. Transformers are needed because the voltage developed by an electric generator is too large to be introduced safely into homes, and is usually too small for the economical transmission of power for any great distance. The reason for the present wide use of alternating current is that its voltage can be changed by transformers far more easily and efficiently than direct-current voltage can be changed by any device.

Use in Power Transmission. The number of watts of power carried by any electrical circuit is always equal to the product of the electrical pressure in volts and the current in amperes; that is, watts = volts × amperes. A given number of watts of power can therefore be transmitted by means of many combinations of voltage and current. It is cheaper, however, to transmit a given amount of power as a small current at high voltage than as a large current at low voltage: (1) Smaller wires can be used for small currents, hence there is a saving in the cost of wire for constructing the transmission line, and copper is saved for other purposes. (2) There is much less loss of power from heating of the line when a small current is used; in fact, a one-ampere current develops only one hundreth as much heat each second as a ten-ampere current (see ELECTRIC HEATING).



Allis-Chalmers

A TRANSFORMER FOR DISTRIBUTING electricity to homes is mounted in a protecting case on a pole.

Since transformers have no moving mechanical parts there is little loss of power in them and they are usually 95 to 99 per cent efficient. A *step-up* transformer receives alternating current at one voltage from a supply line, the *primary* circuit, and delivers practically the same amount of power to another circuit, the *secondary,* but at a higher voltage. A *step-down* transformer decreases the voltage transferred to the secondary circuit.

Some voltages that might be used in the distribution of electric power are shown in Fig. 1. In one operating system, a series of three substations is used to step down the 220,000 volts of a long-distance transmission line to 66,000, 13,200, and 2,300 volts before the power is distributed to a city. A photograph of the huge transformers used to transfer power from generators to a transmission line is given in the article ELECTRICITY. Small transformers are used to reduce the 115 volts of the house circuit to the eight or ten volts needed for operating toy electric trains or for ringing doorbells (see ELECTRIC BELL); large ones step up 115 volts to the high voltages used for igniting

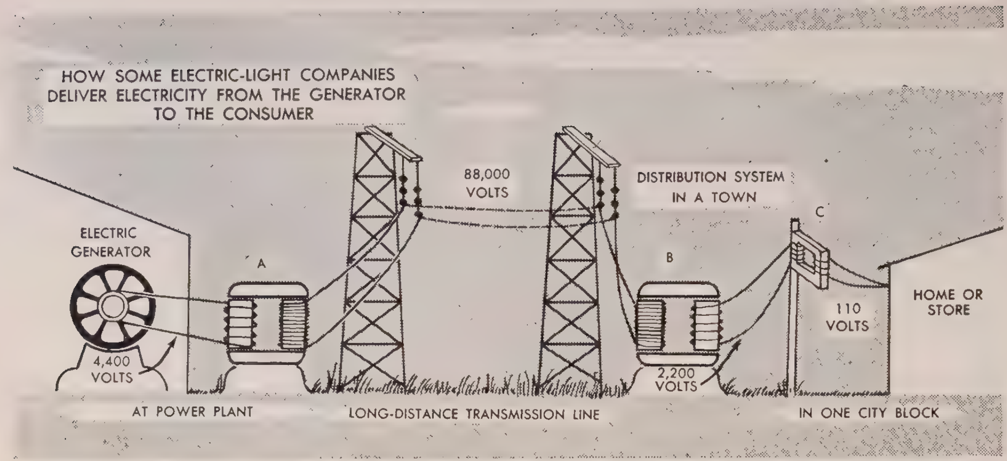

HOW SOME ELECTRIC-LIGHT COMPANIES DELIVER ELECTRICITY FROM THE GENERATOR TO THE CONSUMER
ELECTRIC GENERATOR
4,400 VOLTS
A
88,000 VOLTS
DISTRIBUTION SYSTEM IN A TOWN
B
C
2,200 VOLTS
110 VOLTS
HOME OR STORE
AT POWER PLANT
LONG-DISTANCE TRANSMISSION LINE
IN ONE CITY BLOCK

FIG. 1. A STEP-UP TRANSFORMER at *A* increases the voltage in transferring electric power from a generator circuit to a long-distance transmission line. Before the current is carried into a city, its voltage is reduced by a step-down transformer in a substation at *B;* before it is sent into a group of homes, its voltage is again reduced by a transformer mounted on a pole in the alley at C.

the oil in oil burners, and for operating X-ray tubes and also luminous-tube signs, both indoors and out. Large step-down transformers are used in industry to provide the large currents needed to operate machine tools, to heat electric furnaces, and for welding. The many kinds of devices in which transformers are used include radios, automobile ignition systems, relays, and measuring instruments.

Construction and Operation. The simple transformer in Fig. 2 consists of a rectangular iron core around which are wound two coils of wire. The turns of the coils are insulated from one another and from the core. One coil is connected to the primary, the other to the secondary, circuit. When an alternating current is sent through the primary coil, an alternating magnetic field is produced in the iron core (see ELECTROMAGNET; MAGNET AND MAGNETISM). As this magnetic field changes in strength and direction, an alternating electromotive force, or voltage, is induced (set up) in the secondary coil (see ELECTROMOTIVE FORCE). This phenomenon is called *electromagnetic induction.* If the secondary circuit is a closed one, an alternating current flows through it. (However, if a steady, direct current should be sent through the primary coil, there would be a steady magnetic field in the core, but no current would be induced in the secondary.)

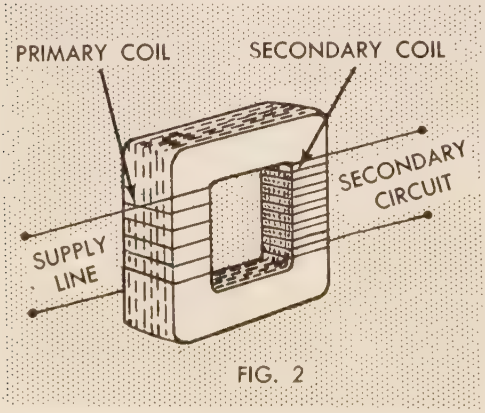


FIG. 2

The greater the number of turns in the secondary coil, the greater is the voltage induced in it. If the secondary coil has ten times as many turns as the primary coil, the voltage induced in the secondary is ten times that in the primary; or if the secondary has one third as many turns as the primary, its voltage is likewise one third that in the primary. In general, the ratio of the voltages in the primary and secondary coils is equal to the ratio of the number of turns in their windings. That is,

$$\frac{\text{voltage in secondary}}{\text{voltage in primary}} = \frac{\text{turns in secondary}}{\text{turns in primary}}$$

Because the two coils carry the same power the current is increased when the voltage is decreased, and hence it is also true that

$$\frac{\text{current in secondary}}{\text{current in primary}} = \frac{\text{turns in primary}}{\text{turns in secondary}}$$

The chief cause of power loss in a transformer is the heating of the iron core by "eddy" currents induced in it by the changing magnetic field. If the core is laminated, that is, built up of thin sheets of iron insulated from one another, these eddy currents are broken up and the power lost as waste heat is kept small. To remove the small amount of heat that is developed, oil is circulated around the coils. See also INDUCTION COIL.

TRANSFU'SION, Blood. See Blood.

TRAN'SISTOR, an electronic device that can take the place of a three-element vacuum tube (triode) as an amplifier in radio receivers, telephone circuits, and other installations where the power output is small. It can also be used as a pulse amplifier and as an oscillator (see Radio, *Transmitter*). Transistors are much smaller and far more rugged than equivalent vacuum tubes, do not have to be warmed up, and use an extremely small amount of power. They are made of crystals of the element germanium, a semiconducting material in which the number of electrons available for carrying electric current is very small and can be controlled.

In the first form of transistor, invented in 1948, two fine wires (cat's whiskers) touch a germanium crystal soldered to the metal base of the pencil-slim cylindrical metal container, their tips only two thousandths of an inch apart. The input whisker is said to control the flow of current to the output whisker, or collector, much as the grid in a vacuum tube controls the flow of electrons to the plate.

Smaller and even more efficient is the *junction* transistor in which surface contacts replace the point contacts of the earlier device. It is a tiny rod made up of a thin, electrically positive layer of germanium sandwiched between electrically negative germanium ends. Lead wires from the three sections pass through an enclosing shell of hard plastic, about half the size of a pea. This device can give a millionfold amplification to an electric signal and use only a millionth of the power required by its vacuum-tube counterpart.

TRANS'IT, in astronomy, a term that refers to the crossing of the meridian by any of the heavenly bodies. The solar day is the time interval between transits of the sun; the sidereal day is the time between one transit of a star and the next transit of that star (see Day). The term also means the passage of a planet across the disk of the sun or of a satellite across the face of a planet. A transit of Venus or Mercury occurs when either planet comes between the earth and the sun and is seen as a dark object moving across the sun's disk. There are frequent transits of Jupiter's satellites across its face.

TRANSIT, in surveying, an instrument used to extend straight lines, measure horizontal and vertical angles, and determine distances and heights. It consists essentially of a telescope that may be rotated horizontally and vertically against scales which show the angles by which it is moved. It may also have a compass and one or more spirit levels and adjusting mechanisms by which its base, mounted on a tripod, may be made level. To lay out a straight line, the surveyor turns the telescope until it points in the required direction, then looks through the telescope and directs an assistant to place a rod so that it is exactly in line with a fine upright line on the telescope. By repeatedly moving the transit up to the rod, he can extend the line as far as necessary. He can angle the line as necessary by moving the telescope across the scale, or he can determine the angle at which a line turns by observing the markings on the scale before and after the telescope is moved. By using a specially marked rod, the surveyor can determine the distance between two points. The angle between two points also aids him in determining the distance between them by trigonometry (see Trigonometry).

TRANSJOR'DAN. See Jordan.

TRANSMIGRATION, *trans my gra'shun,* **OF THE SOUL**, or **METEMPSYCHOSIS**, *meh temp sih ko'sis,* the belief that after the body dies, the soul passes into some other material form — into another human body, or even into the body of some lower animal. Thus transmigration involves belief in the *pre*-existence as well as the survival of the soul after death; it is the conviction that the soul is not only indestructible, but uncreated — *eternal* in the strictest sense. The doctrine appears in many religions, among them the Hindu and the ancient Egyptian, and it was held by many Greek and Roman philosophers, notably Plato, who expounds and gives several "proofs" for it in his dialogue *Phaedo.*

TRANSMISSION. See Automobile.

TRANSMUTA'TION OF ELEMENTS occurs when an atom of one chemical element is transformed into an atom of a different element. Such a transformation involves a change in the atomic number of an atom, that is, in the number of units of positive charge carried by its nucleus, or central core. See Atom; Chemistry, *Elements;* Periodic Table.

Spontaneous transmutation occurs in the naturally radioactive elements, all of which have high atomic weights. Radioactive disintegration, or decay, of a nucleus of one of these elements takes place with the emission of an alpha particle or a beta particle (see Beta Particle). Thus a radium nucleus emits an alpha particle and becomes a radon nucleus; a nucleus of thallium emits a beta particle and becomes a nucleus of a lead atom.

Artificial Transmutations are brought about by bombarding a target substance with suitable particles or with gamma rays of high energies. Such experiments are undertaken primarily to increase our understanding of the nature of matter, but they have also produced useful new varieties of atoms of known elements (see Isotopes), and atoms of elements that were unknown before, such as plutonium and technetium.

Particles used for bombardment may be uncharged neutrons or high-speed charged particles: electrons, alpha particles, and nuclei of the three isotopes of hydrogen, namely, protons, deuterons, and tritons. A wide variety of devices (particle accelerators, or "atom smashers") are now used to give high speeds and energies to these charged particles: for example, betatrons, cyclotrons, linear accelerators, voltage multipliers, Van de Graaff electrostatic generators, synchrotrons, and synchrocyclotrons.

It is thought that, in most cases, a bombarding particle and the nucleus it enters form momentarily a *compound nucleus* that is unstable and at once emits a particle (sometimes two). The expelled particles are not limited to alpha and beta particles as in natural radioactive decay, but may be *photons* (high-energy radiation), *positrons* (positive electrons), and all particles used as projectiles. The so-called *recoil nucleus* left behind is usually radioactive, whether it is light or heavy; its radioactivity is called *artificial radioactivity.*

The sum of the charges on all nuclei and particles is the same after a nuclear reaction as before it, and likewise the total number of neutrons and protons in them, that is, the total mass number. But the actual mass of the particles resulting from the reaction may be less than the mass of the interacting particles because the difference in mass has been converted into energy (see CONSERVATION OF MATTER AND ENERGY; MASS). Because the proportion of "hits" is very small, however, the total energy released in a bombardment experiment is always much less than the energy used up in speeding up all the bombarding particles. In some nuclear reactions energy is converted into mass.

Examples. The British physicist Rutherford achieved the first artificial transmutation in 1919 by bombarding nitrogen with alpha particles from a naturally radioactive source. Here the target nucleus is nitrogen 14 (mass number, 14), the ejected particle is a proton, and the recoil nucleus is oxygen 17, which is stable (nonradioactive). The alpha particle and nitrogen nucleus together have a charge of $2 + 7$ and a mass number of $4 + 14$; the proton and oxygen nucleus have a charge of $1 + 8$ and a mass number of $1 + 17$.

A long-lived radioactive isotope, carbon 14, important in studies of chemical and biological processes, is produced in nuclear reactors by the interaction of a neutron with nitrogen 14 and the emission of a proton. Before the reaction the charge is $0 + 7$ and the mass number $1 + 14$; after the reaction the charge is $1 + 6$, the mass number $1 + 14$. The same isotope is formed in nature when neutrons in cosmic rays hit nitrogen nuclei in the atmosphere. See ISOTOPES, *Uses;* TRITIUM.

Fission is a transmutation process that occurs in elements of high atomic weight; it is the breaking up of a heavy nucleus into two nuclei. Since these two fission fragments, and usually their decay products as well, are radioactive, a number of fission products are formed, all of which are nuclei of elements in the intermediate range of atomic numbers, such as bromine, molybdenum, cesium, and so on. Less well understood than fission is *spallation,* in which a great many pieces, perhaps 20 to 100, are chipped off a target nucleus that is struck by a particle of exceedingly high energy.

Fission has been induced by most of the particles that induce other transmutations, but the first fission to be recognized was the one that opened the way to the practical utilization of atomic energy, namely, the fission of a uranium-235 nucleus that had absorbed a slow neutron. At each fission two or three neutrons are released and a much greater amount of energy (converted from mass) than in ordinary nuclear reactions. In circumstances in which some of these neutrons can induce other fissions, thereby releasing more neutrons to induce still more fissions, a self-sustaining chain reaction builds up in which the output of energy is tremendous. The energy from an uncontrolled chain reaction in uranium 235 or plutonium 239 is released very abruptly in an atomic-bomb explosion; that from a controlled chain reaction in the same materials is released gradually in a nuclear reactor.

Nuclear reactors used as research instruments and for the production of radioactive isotopes are operated at power levels ranging from a few watts to some 10,000 kilowatts. In 1951, waste heat from a British experimental reactor (6,000 kw.) was put to work heating a building. In a trial run in December, 1951, about 100 kilowatts of electric power were produced by another experimental reactor at Arco, Idaho. The liquid metal that cools the reactor was allowed to circulate in pipes surrounded by water, thus carrying heat from the reactor to the water and producing steam. The steam, in turn, was used to drive the turbine-generator that produced the power (see TURBINE). Large amounts of power are now developed by the reactors that produce fissionable plutonium for military purposes and will be developed by reactors designed primarily for production of power. See also ALCHEMY.

TRANSPIRA'TION. See LEAVES.

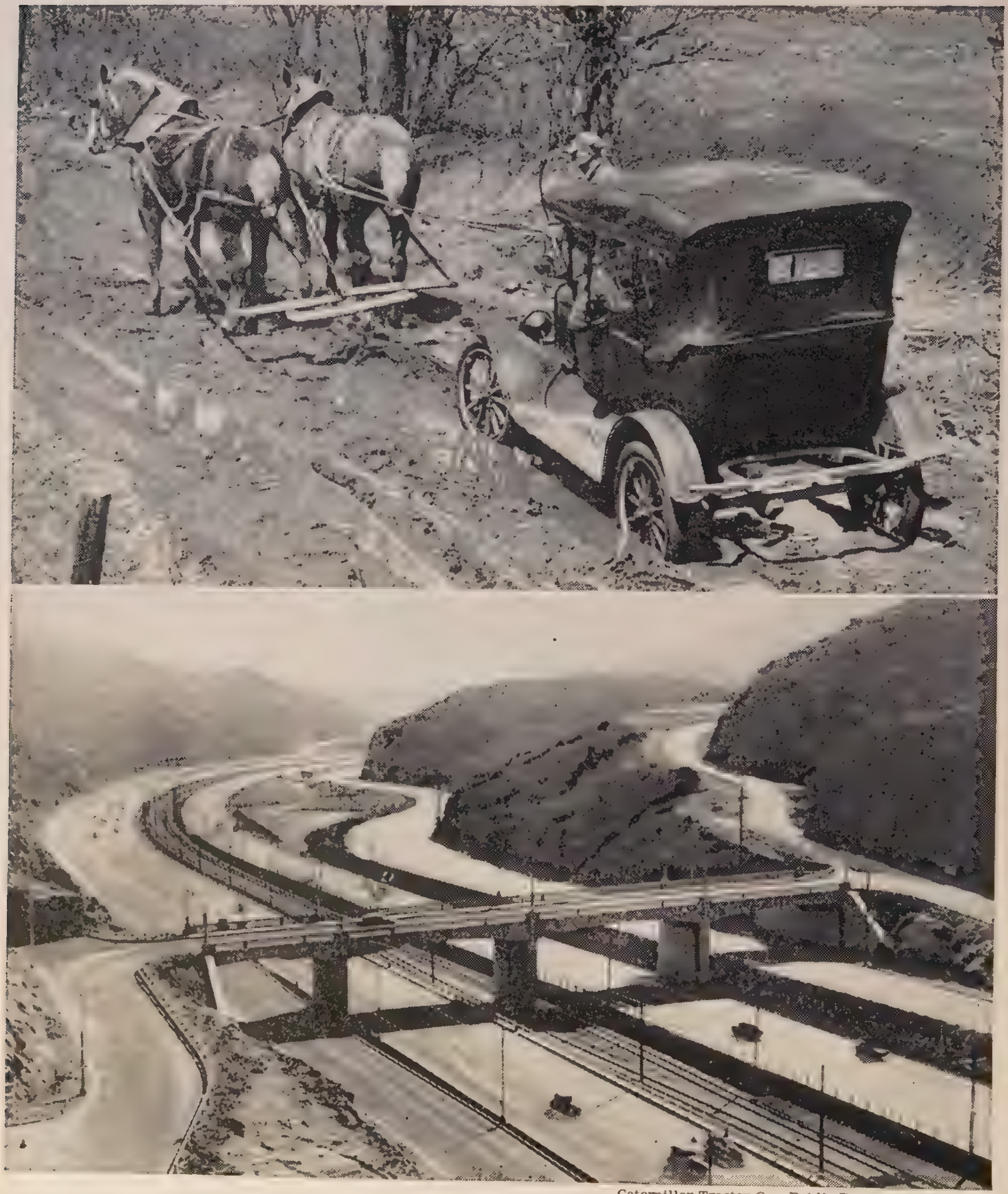
TRANSPLANTING, TREE. See TREE.

The Mariners' Museum, Newport News, Va., Acme Photo

GREYHOUNDS OF THE SEVEN SEAS in the days of sailing ships were the fast and beautiful clippers. By the middle of the nineteenth century, however, the ancestors of the modern power-driven ocean liner were taking over the shipping lanes of the world.

TRANSPORTA′TION, the transfer of persons or things from place to place. Modern civilization depends on safe and speedy transportation in numerous ways. Transportation not only serves all other industries but is in itself a huge industry. The making of ships, automobiles, airplanes, and railroad cars, the building and repair of docks and piers, the construction of roads, the laying of railroad tracks, and the establishment of airports — all these tasks require hundreds of thousands of workers. The United States spends about one fifth of its annual income on transportation. The cost of transportation is high, but if it were not for transportation we would have little income to pay for anything. Without transportation, crops would rot in the fields, industries could neither receive raw materials nor distribute their manufactures, and cities would quickly face starvation.

Transportation and Better Living. To a very large extent we depend on transportation for what we eat, drink, wear, and read, for the medicines we need, for the work we do and the entertainment we enjoy, for the furnishings in our homes, and even for the homes themselves. In the civilized world there are very few communities that produce all the things their people need. Even the most commonplace articles may consist of a combination of materials brought together, by means of transportation, from regions thousands of miles apart. A suit of clothes, for example, may consist of wool from Australia, silk from China, jute from India, buttons of vegetable ivory from Brazil, cotton from Texas, and dyes made from coal



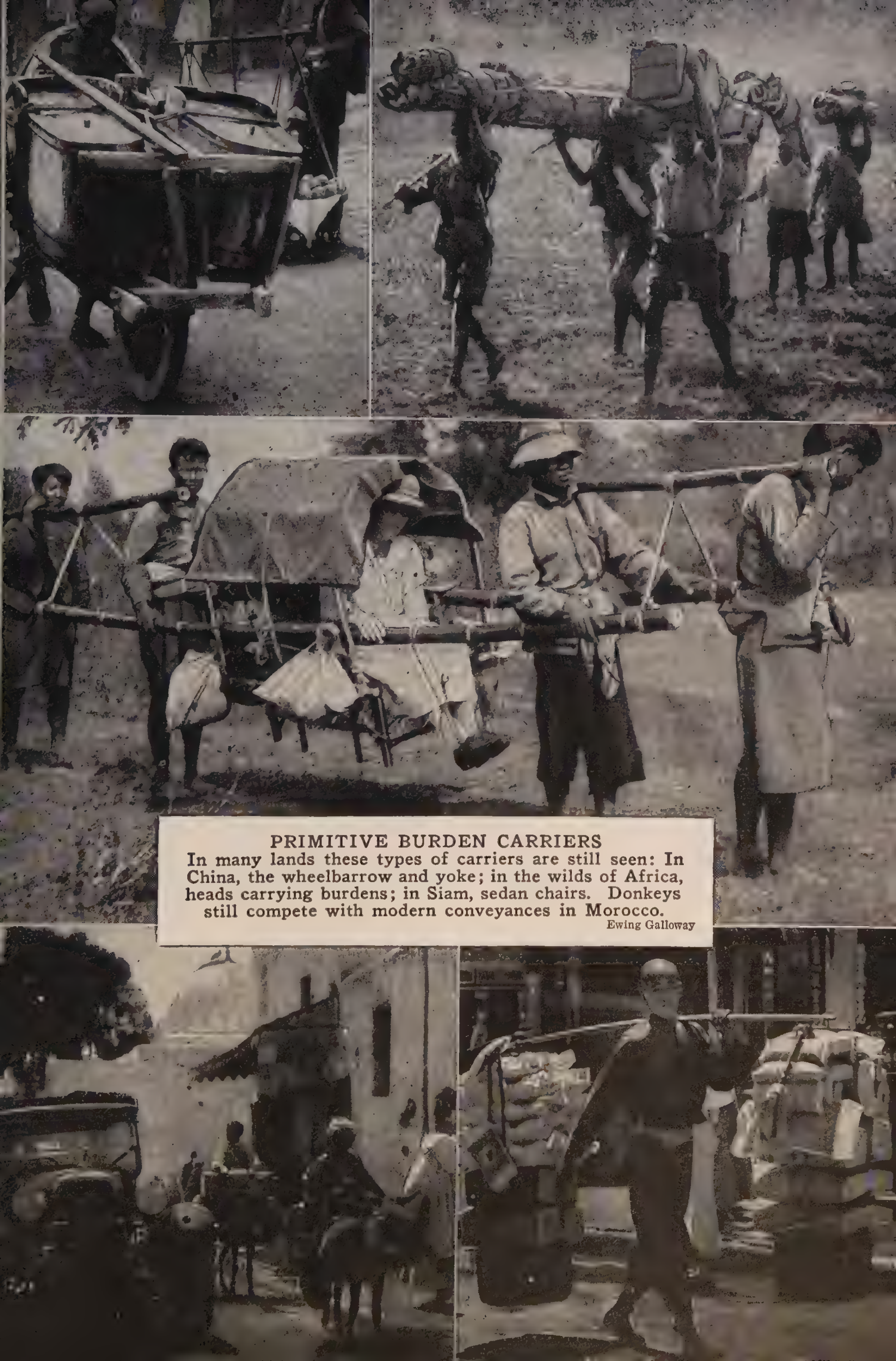
Caterpillar Tractor Co.; Public Roads Administration

THE AUTOMOBILE WAS CAUGHT IN A RUT during its early history, for there were few roads upon which it could travel with full efficiency. By launching modern highway engineering, the automobile changed the face of nations all over the world.

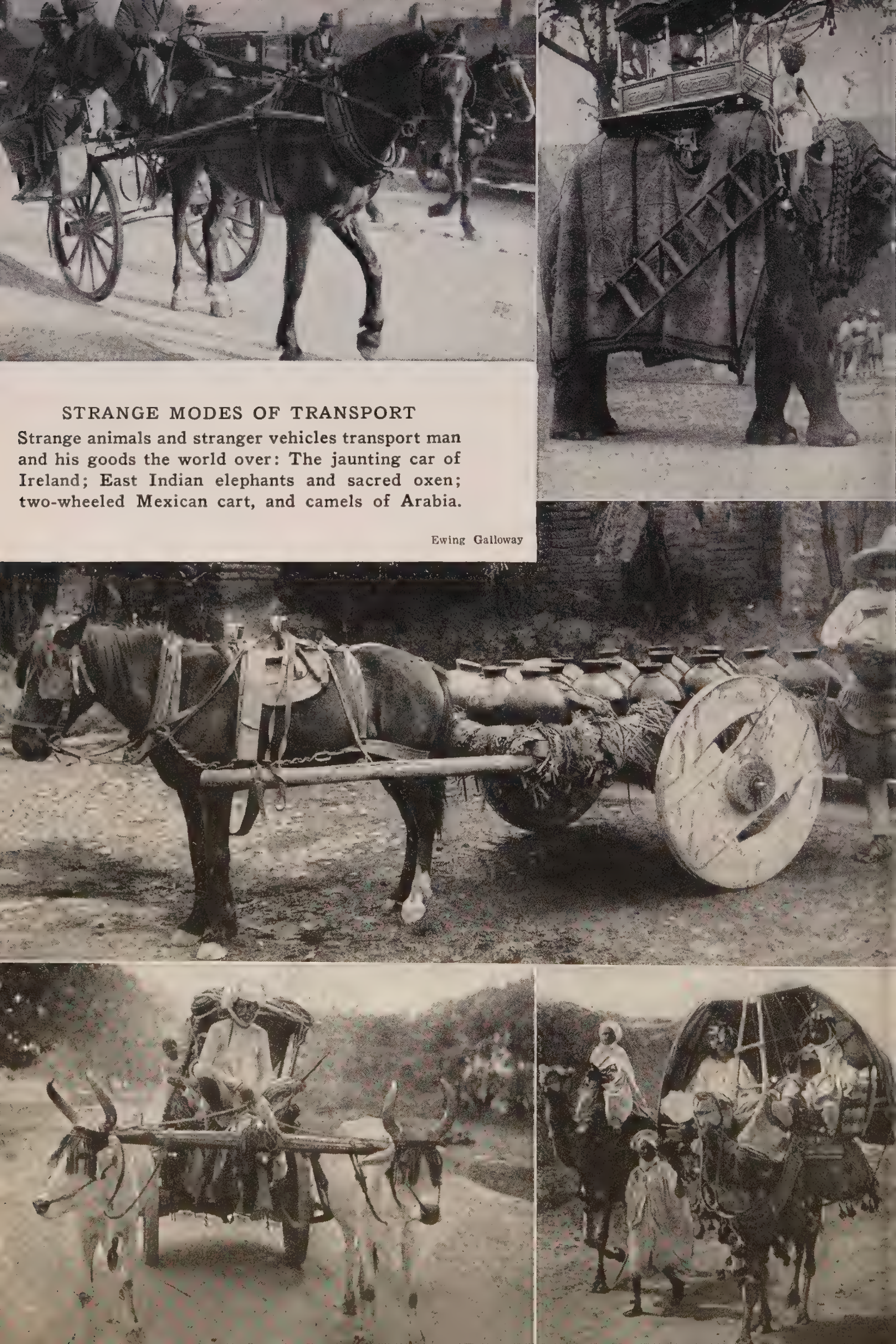
and other ingredients produced at a distance.

Thus modern transportation enables us to enjoy the products of far-distant regions. At the same time it makes it possible for us to make fuller use of resources near us by supplying these things to people far away. If it were not for transportation, salt from a rich salt deposit could be used only by the people living nearby. Transportation enables these people to ship the salt to distant markets and thus earn money with which to purchase goods that are not available near at hand (see COMMERCE).

Not only does speedy, safe, efficient transportation permit us to eat better and more varied foods, wear better clothing, live in better homes, and enjoy recreations that would otherwise be denied us; it also pro-



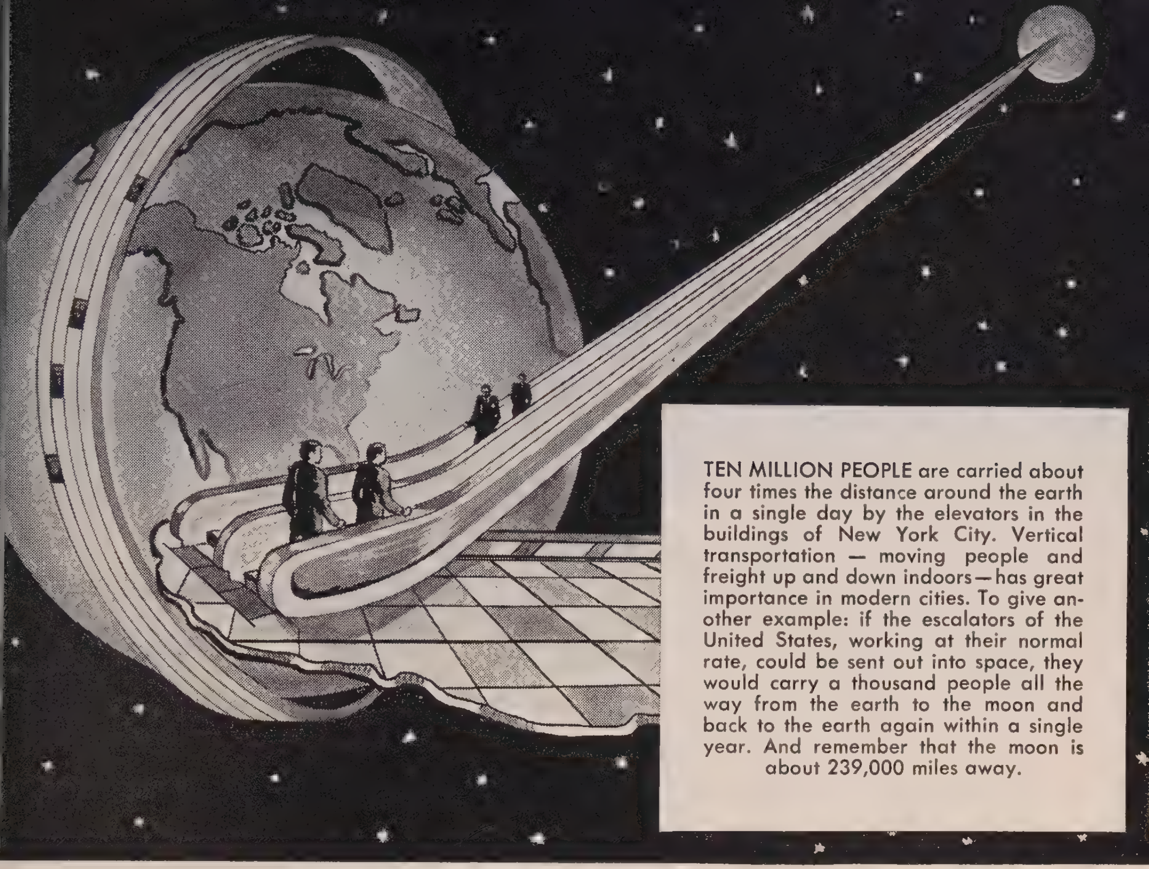
PRIMITIVE BURDEN CARRIERS
In many lands these types of carriers are still seen: In China, the wheelbarrow and yoke; in the wilds of Africa, heads carrying burdens; in Siam, sedan chairs. Donkeys still compete with modern conveyances in Morocco.
Ewing Galloway



STRANGE MODES OF TRANSPORT

Strange animals and stranger vehicles transport man and his goods the world over: The jaunting car of Ireland; East Indian elephants and sacred oxen; two-wheeled Mexican cart, and camels of Arabia.

Ewing Galloway



TEN MILLION PEOPLE are carried about four times the distance around the earth in a single day by the elevators in the buildings of New York City. Vertical transportation — moving people and freight up and down indoors—has great importance in modern cities. To give another example: if the escalators of the United States, working at their normal rate, could be sent out into space, they would carry a thousand people all the way from the earth to the moon and back to the earth again within a single year. And remember that the moon is about 239,000 miles away.

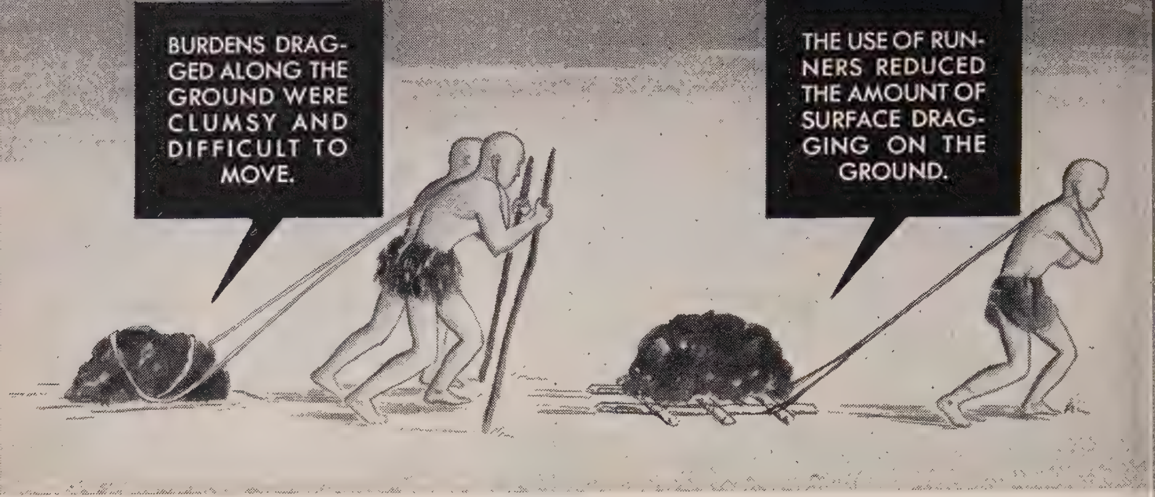
tects us by bringing the doctor, the police, and the fire department in times of emergency. Easy transportation has enabled the farmer to share the benefits of town life and brought the city dweller closer to the open air and natural beauty of the country.

Mother of Cities. Cities are dependent on transportation for food, fuel, clothing, medicines, and other necessities, for raw materials, and for a means to market their products. In earlier times, water routes provided the best means of transportation, and even today most of the world's large cities are located on rivers, lakes, and seacoasts. With the development of land travel, the number of the world's cities was greatly increased, and urban populations have continued to grow. Within cities a well-organized transportation system is needed to carry people between their homes and places of work, stores, theaters, and churches. Larger communities may require bus and streetcar lines and elevated and subway systems, as well as taxis and private motorcars, to provide adequate transport. As a result the regulation of traffic in big cities is a major problem (see CITY PLANNING).

Big-city transportation includes vertical, or up-and-down, movement. In the United States, escalators, or moving stairways, carry more persons than the Class A railroads, and the number of persons transported annually by elevators is ten times the population of the world. The skyscraper building would not be practical without the service of elevators (see ELEVATOR).

Industry and Agriculture. Efficient transportation reduces the cost of assembling the materials used by industries, and makes it cheaper for companies to market their products. Thus it enables the consumer to pay less for what he buys. Short-distance transportation by conveyors, cranes, fork lifts, and other power-operated motorized equipment reduces the cost of handling materials, saves time, and therefore also lowers retail prices (see CONVEYORS; CRANE). With modern transportation, farmers can sell their products in distant markets and can specialize in the crops for which their farms are best suited. Today's farms depend upon the power tractor, which enables farmers to work their fields in a fraction of the time formerly required (see AGRICULTURE; FARM MACHINERY; TRACTOR).

Government Aid and Regulation. Transportation and public safety and welfare are very closely related. In most major nations the national government constructs or assists in the construction of highways, dredges


BURDENS DRAGGED ALONG THE GROUND WERE CLUMSY AND DIFFICULT TO MOVE.
THE USE OF RUNNERS REDUCED THE AMOUNT OF SURFACE DRAGGING ON THE GROUND.

navigable channels in harbors, lakes, and rivers, establishes navigation aids for ships and planes, and helps out transportation in other ways. It may give airlines or railroads financial encouragement through subsidies (see SUBSIDY). Through the Interstate Commerce Commission, the United States Government regulates commercial carriers, doing business across state lines, in the interest of the public (see COMMON CARRIER; INTERSTATE COMMERCE COMMISSION).

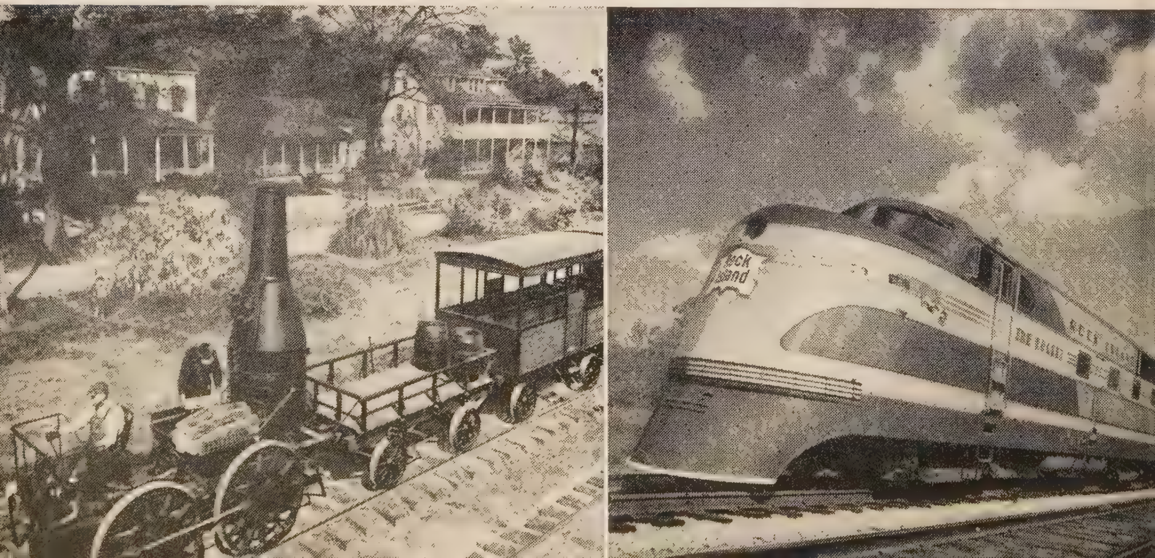
State and provincial and local governments also build roads and streets, construct airports, and regulate common carriers operating within their jurisdiction. States license automobile drivers, establish speed limits, and otherwise regulate traffic.

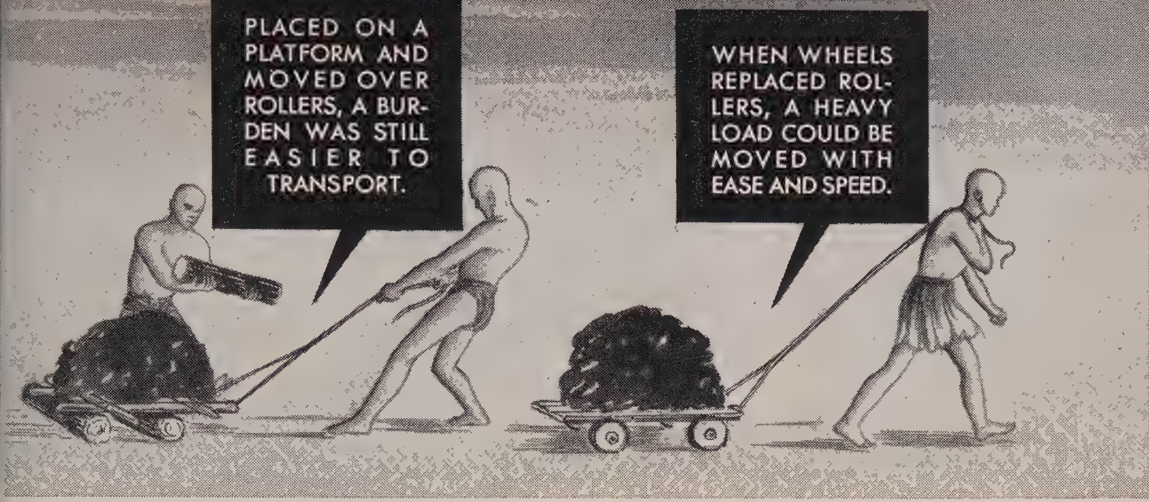
Transportation and War. The oldest highway system of which there is record, developed by the ancient Persian Empire, was constructed primarily for military purposes. The excellent Roman roads were also built for marching armies. Until after the fall of Rome the military chariot was more commonly used than any other wheeled vehicle. Horses were used chiefly by armies until fairly modern times. Today military planes far outnumber commercial planes. Throughout history, speedy, efficient transportation has been extremely important to military action. General Nathan Forrest (1821-1877) said that battles are won by the side that "gits thar fustest with the mostest." Nations at war produce airplanes, ships, trucks, and other vehicles in far greater number than they do in peacetime. The destruction of enemy railroad centers, seaports, and bridges is one of the most important objectives in warfare.

History. Early man could move his burdens only by carrying, pulling, or pushing them himself. His earliest transportation

THE LITTLE, AMERICAN-MADE WOOD BURNER, "Best Friend," placed in service in South Carolina in 1830, stands at the top of the family tree of American locomotives. Its descendants include the sleek, powerful diesel locomotives which span the continents today.

Rock Island Lines: American Association of Railroads

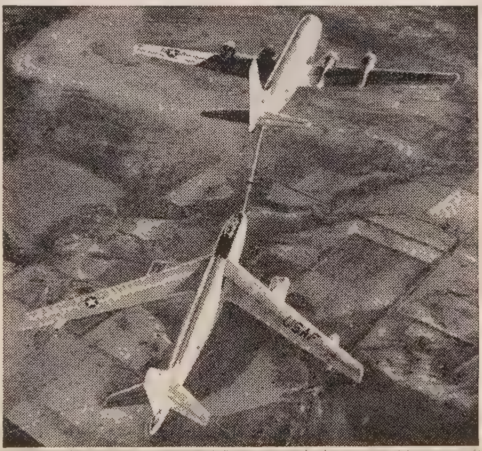



PLACED ON A PLATFORM AND MOVED OVER ROLLERS, A BURDEN WAS STILL EASIER TO TRANSPORT.
WHEN WHEELS REPLACED ROLLERS, A HEAVY LOAD COULD BE MOVED WITH EASE AND SPEED.

aids on land were the sled and the travois (see Eskimo; Indians, American). By presenting a smaller surface to the ground than the load itself, these devices reduced friction. Later, friction was further reduced by moving the sled over rollers — a method still used in moving boats on a beach. The travois, the sled runners, and the rollers were probably all developed from the staff, man's basic implement.

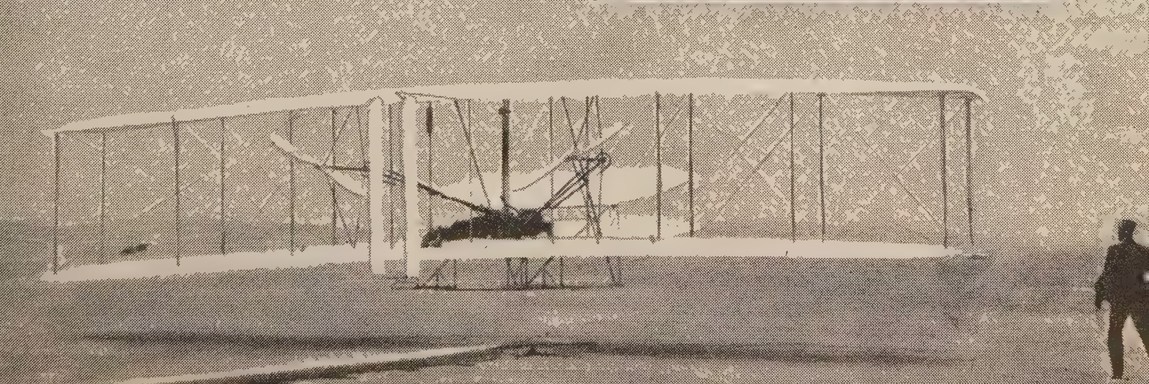
During the Late Stone Age, man took a great step forward when he domesticated animals (see Domesticated Animals; Stone Age), making cattle, horses, and other creatures his burden bearers. About five thousand years ago, in western Asia, he invented the wheel, one of the most important of human inventions (see Wheel; Wheel and Axle). The first wheels were probably sections of large rollers. Then larger, solid wheels were made from boards. Such wheels are still used on oxcarts in many lands, though wheels with spokes were known in Egypt at least 3,500 years ago. The wheels were rimmed with leather, copper, and iron to reduce wear.

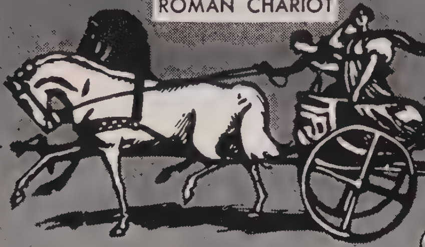
What the earliest means of water transportation were may be judged from the most primitive craft in use today. Logs and rafts of logs, bundles of reeds and grasses, and the inflated skins of animals were used in the distant past. In the Stone Age men hollowed logs to produce the dugout and covered a frame with skin to make the round coracle. Craft of the coracle type reach a high state of development in the Eskimo kayak and umiak. Eventually wooden boats were constructed (see Boat). Probably the first boats were pushed along with poles, but paddles,



TWENTIETH-CENTURY TRANSPORTATION has as its symbol the airplane. From the flimsy craft of the Wright brothers has been developed the superfast jet, here refueling in mid-air.

Acme Photo; Wide World




ROMAN CHARIOT

CONESTOGA WAGON

ONE-HORSE CHAISE

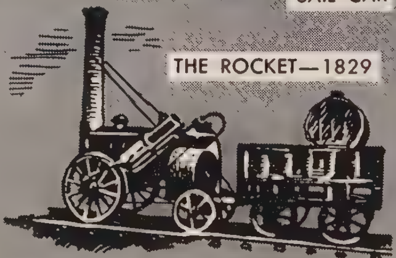
COACH

VEHICLES IN GREAT VARIETY HAVE TRANSPORTED MAN over the land. They have been propelled by man himself, by domesticated animals, by the wind, by steam, by electricity, by gasoline, and by fuel oil.

SAIL CAR

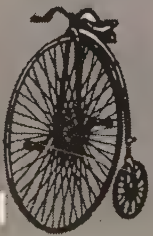
TREADMILL CAR

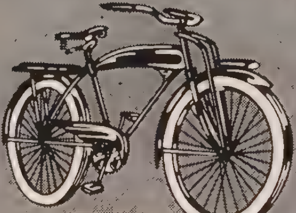
HORSE CAR


THE ROCKET—1829

FIRST STEAM VEHICLE

DANDY HORSE

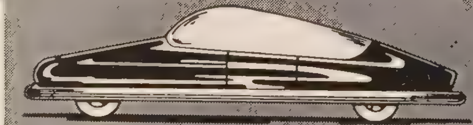

HIGH WHEELER

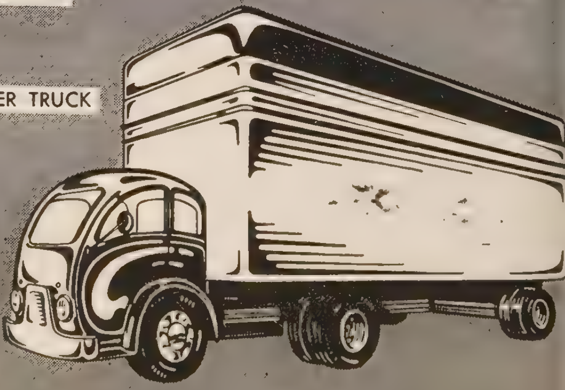

BICYCLE

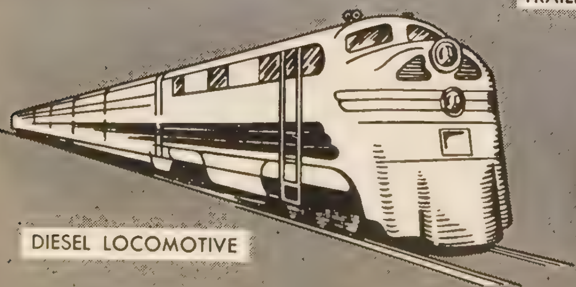
HORSELESS CARRIAGE

EARLY AUTO

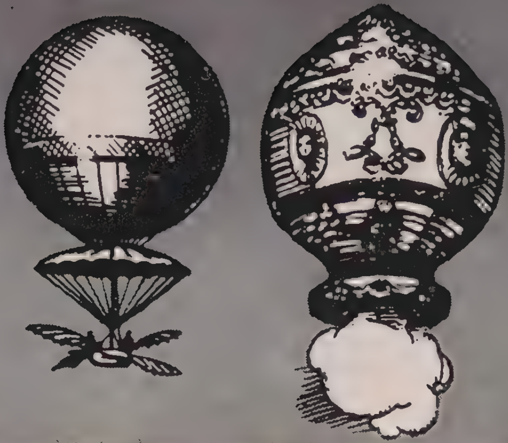
THE INTERNAL-COMBUSTION engine changed the transportation picture throughout the modern world. For millions, the automobile has become one of the essentials of everyday living.


STREAMLINED CAR

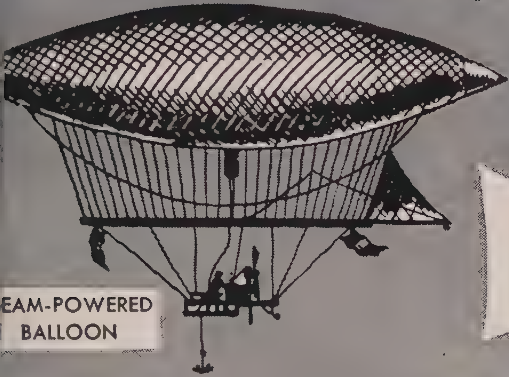

TRAILER TRUCK


DIESEL LOCOMOTIVE

PRIMITIVE GLIDER

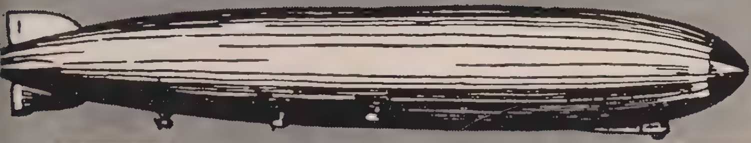


EARLY BALLOONS

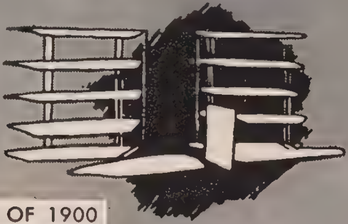


EAM-POWERED BALLOON

MAN LONGED TO FLY FOR CENTURIES, then learned to fly in a few decades of amazing progress. The skyways are avenues of transportation in this modern age of flying.

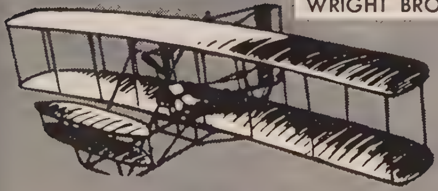


DIRIGIBLE



GLIDER OF 1900

WRIGHT BROTHERS' PLANE

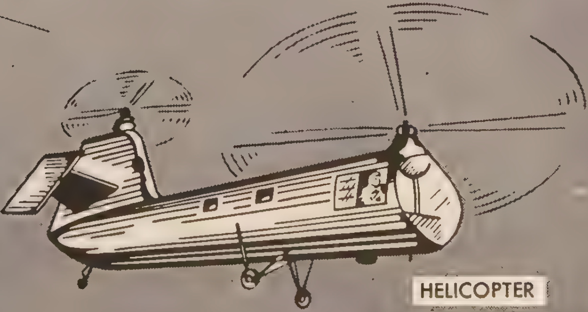


CURTISS' FLYING MACHINE

JET FIGHTER

SINCE THE BEGINNING of the twentieth century the development of the airplane has speeded transportation so greatly that the most widely separated parts of the earth have been brought into close contact.

AIR LINER



HELICOPTER

FLOATING LOG

DUGOUT

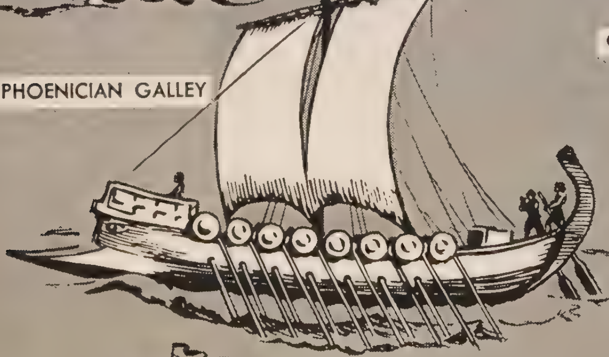
CORACLE

THE WATERWAYS OF THE WORLD have served man as highways for travel and trade since earliest times. At first, man depended upon his own muscles to move his craft. Later, he harnessed the winds. And finally he invented powerful engines to drive huge vessels through the open seas.

CRUSADERS' SHIP

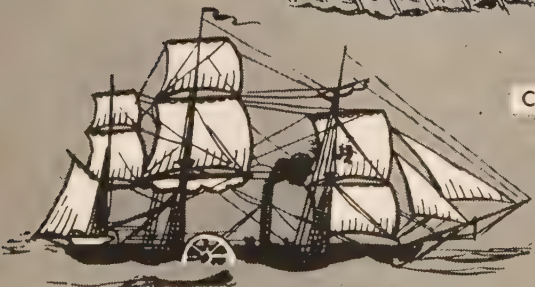
EGYPTIAN VESSEL

GALLEON

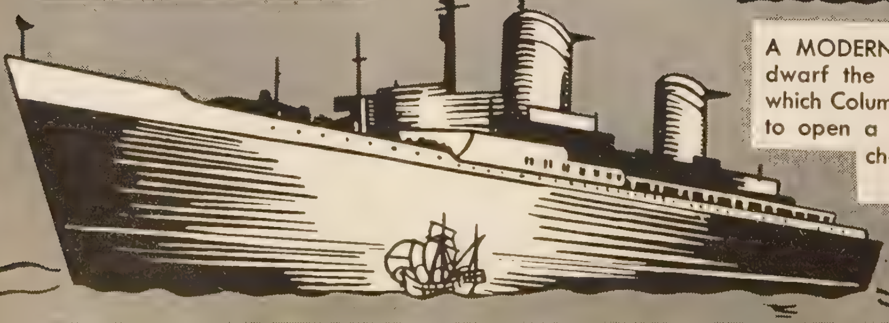


PHOENICIAN GALLEY

COASTAL SCHOONER



FIRST TRANSATLANTIC STEAMER



A MODERN OCEAN LINER woul dwarf the tiny "Santa Maria," i which Columbus crossed the Atlanti to open a new and revolutionary chapter in the history o water transportation oars, and sails came into use very early.

Transportation by water, particularly when heavy, bulky loads had to be moved, was much easier than transportation by land. In order to extend the natural waterways provided by rivers, the ancient peoples of Babylonia, Egypt, Persia, and China built canals (see Canal). The people of Crete were active seafarers in the Mediterranean before 1400 B.C., and the ancient Phoenicians ventured out into the Atlantic and may have sailed around Africa centuries before the time of Christ (see Phoenicia). Later, Carthage was mistress of the sea (see Carthage).

Under the Roman Empire transportation reached a high state of development. Horsemen, chariots, and ox-drawn wagons traveled over excellent highways. Barges moved along the rivers and canals. Galleys sailed the seas. After the fall of the empire, transportation declined, but the Crusades revived commerce. Then came the age of discovery, in which men established new trade routes to new lands. The sailing ship gradually replaced the galley and was steadily improved until it reached its peak of speed and beauty in the American clipper of the nineteenth century (see Ship).

Slower progress was made in land transportation. The invention of the swiveled front wheel made four-wheeled vehicles practicable, and coaches came into use. After the middle of the eighteenth century highways were finally improved, and in the following century thousands of miles of canals were constructed in Europe and the United States. Late in the eighteenth century the first fundamental contribution to transportation since the invention of the wheel was produced. This new development was the first practical steam engine. Improvements followed swiftly, and within a few years railroad construction took the place of canal building (see Railroad). The railroad had special importance for America, where far greater distances had to be traveled than in the thickly settled, relatively small countries of Europe. Moving overland far from the waterways, railroads encouraged settlement, commercial development, and the growth of cities all across the North American continent and did much to make the United States a great and truly united nation.

The most serious drawback of railroads was that they could travel only where their rails led and not wherever they were needed. As a result experiments with road-traveling steamcars continued. Other inventors worked on internal-combustion engines (see Gasoline Engine), and still others developed vehicles powered by electric batteries. The gasoline cars were quicker to start than the steamers and more powerful than the electrics, and they developed more horsepower in relation to weight and could be fueled for longer trips than either. In time they became the chosen vehicles for the highway (see Automobile). After the 1930's another internal-combustion engine, the diesel engine, replaced the steam engine on many railroads (see Diesel Engine).

As cars became commoner, the demand for better roads grew louder, and after World War I a tremendous highway construction program began, particularly in the United States (see Roads and Highways).

Meanwhile, beginning in the nineteenth century, steam power took the place of sails on ships. But the internal-combustion engine soon competed with the steam engine at sea as well as on land. The diesel engine first made ocean-going submarines practical and then came into wide use in vessels of other types as well.

Important as it was on land and sea, the internal-combustion engine was even more significant for air travel. On both land and sea it enabled men only to do better what they had done before. In the air it enabled them to do what they had never done. Balloons had enabled men only to float in the air (see Balloon), and even the power-driven dirigible was a floating rather than a flying machine (see Dirigible). But the airplane brought men the ability to fly. Although flying machines had long been designed, they did not become practical until the Wright brothers began to use the internal-combustion engine (see Aerodynamics). Within half a century the airplane became a decisive factor in war and an important element in peacetime transportation (see Airplane).

With the development of jet propulsion, airplanes attained speeds and altitudes once considered impossible (see Jet Propulsion). Experiments with atomic power gave promise of even greater speeds and longer flights. Mankind, only five hundred years ago able to travel no farther than the ancient Phoenicians and only two hundred years ago able to travel no faster than the Romans, now can give serious thought to travel to the planets.

Related Articles. Many different phases of transportation are treated in these volumes under the following titles:

ANIMAL CARRIERS

Camel
Carabao
Dog
Elephant
Horse
Llama
Mule
Reindeer
Yak
Zebu

GENERAL

Aerodynamics
Air Brake
Airplane
Airport
Aqueduct
Automobile
Balloon
Bicycle
Boat
Bridge

Canal
Canoe and Canoeing
Caravan
Caravel
Chariot
Common Carrier
Compass
Containers
Diesel Engine
Dirigible
Electric Railway
Elevated Railway
Elevator
Eskimo
Flying, Story of
Galleon
Galley
Gasoline Engine
Gliders and Sailplanes
Ice Boating
Jinrikisha
Lighthouse
Lock
Locomotive
Map
Motorboat
Motorcycle
Parachute
Pipelines
Railroad
Roads and Highways
Rowing
Saddle
Safety (Traffic Safety)
Sailboat and Sailing
Ship
Shoes
Signaling
Skis and Skiing
Snowshoe
Steam Engine
Streetcar
Submarine
Subway
Taxicab
Tractor
Tunnel
Wheel
Wheel and Axle

Books for Reading and Reference

Dalgliesh, Alice. *America Travels.* Macmillan. The story of a hundred years of travel in America.

Muller, Charles. *How They Carried the Goods.* Dodd. Transportation from the time of the Pharaohs to the age of flying.

Reck, Franklin Mering. *Romance of American Transportation.* Crowell. Covers the subject from the stagecoach to the airliner.

Van Metre, Thurman William. *Trains, Tracks, and Travel.* Simons-Boardman.

Waldo, Edna La Moore. *From Travois to Iron Trail.* Ackerman.

Webster, Hanson Hart. *Travel by Air, Land, and Sea.* Houghton. A reader for elementary grades.

Outline on Transportation

I. Ancient Methods on Land
  A. Sled and travois
  B. Animal carriers
  C. The first wheel
II. Early Travel on Water
  A. Logs
  B. Rafts of logs, grasses, or skins
  C. Dugout
  D. Coracle
  E. Wooden boats
  F. Galley
III. The Age of Discovery
  A. The sailing ship
  B. The four-wheeled vehicle
IV. The Age of Steam
  A. Steamships
  B. Railroads
V. Gas and Electric Power
  A. Automobile
  B. Diesel engine
  C. Electric motor
VI. The Advent of Flying
  A. Dirigible
  B. Airplane
  C. Jet propulsion
VII. Transportation and Better Living
  A. Benefits to farmers
  B. Effect on city life
  C. Relation to industry
VIII. Regulation and Rules
  A. Government supervision
  B. Subsidies
  C. Traffic rules
  D. Licenses
IX. Use of Transport in War

Questions

What articles used in your home are made from materials transported from distant places?

How does transportation protect a family in emergencies such as illness, an accident, or a fire?

What kinds of transportation are used in your community? How many were in use a century ago?

How did men in early times overcome friction in land travel?

What means of travel on water were used by early peoples?

What have been some of the results of man's first use of the wheel?

What inventions made possible the modern streamliner, the ocean liner, the automobile, and the airplane?

How have farmers benefited by modern forms of transportation?

In what different ways do towns, cities, counties, and states handle transportation problems?

What do boys and girls need to know about traffic rules?

What was the chief purpose of the earliest built roads?

What has road improvement done for modern living?

How has the development of transportation affected international relations?

TRANS-SIBERIAN RAILROAD. See Russia.

TRANSUBSTANTIATION, *tran sub stan-shih a'shun,* the dogma held in the Catholic Church that at the Consecration in the Mass there is a conversion of the whole substance of bread and of wine into the body and blood of Christ, the species of bread and wine alone remaining. At their ordination, Catholic priests receive the power to effect this substantial change by pronouncing the words of consecration: "For this is My body" and "For this is the chalice of My blood, of the new and eternal testament, the mystery of faith, which shall be shed for you and for many, to the remission of sins." See also Eucharist.

TRANSVAAL, *trans vahl',* The, is the northeastern province of the Union of South Africa. It stretches for about three hundred miles between the Limpopo River on the north and the Vaal River on the south, and has an area of 110,450 square miles. The Transvaal is a subtropical land of high, rolling, grassy plains, mountains, and rocky ridges with rich mineral deposits, especially gold. Its name means *across the Vaal.* The mineral wealth of the province is responsible for the development of industry and the rise of towns like Johannesburg, the largest city in South Africa. The high *veld,* or grassland region, from 4,000 to 6,000 feet above sea level, provides excellent grazing for flocks of sheep and herds of cattle. Corn (called *mealies*), tobacco, grains, vegetables, and fruits are grown on the farms.

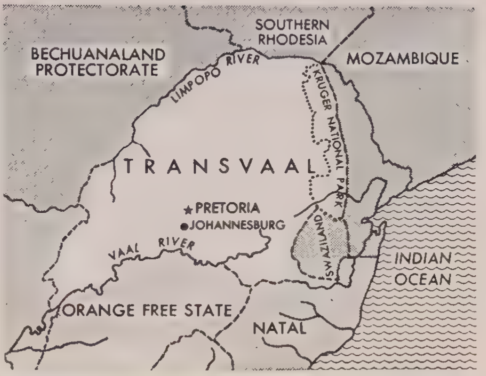
Climate and Natural Resources. The province has no seacoast, and the coastal mountain ranges in Natal and Mozambique, to the east, cut off the moisture-bearing winds blowing from the Indian Ocean, so that rainfall in the Transvaal is generally light. Because the land is high, the dry, subtropical climate is not unpleasant.

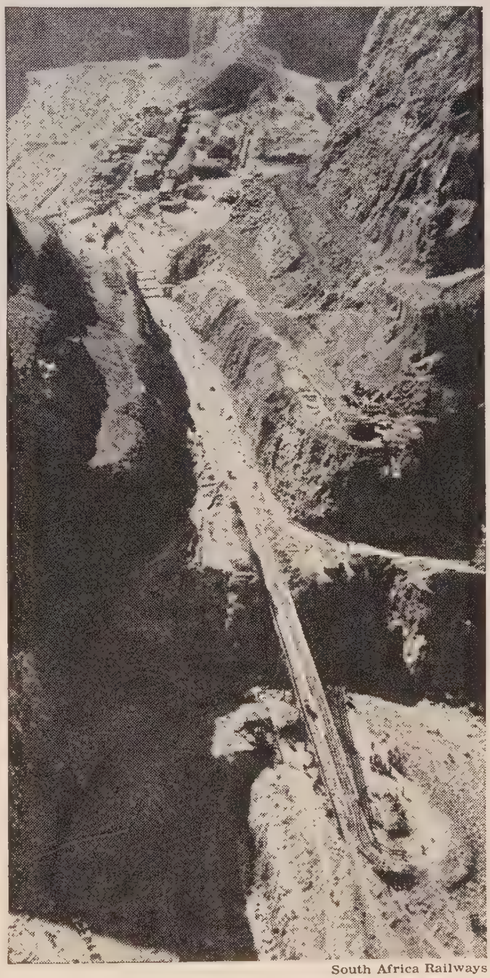
Just north of the Vaal is the Witwatersrand (White Waters Ridge), a rocky plateau fabulously rich in gold deposits. Gold was discovered in the Rand in 1884, and the gold mines in the vicinity of Johannesburg yield millions of tons of ore each year. Some mining operations are carried on 9,000 feet below the surface of the ground. Diamonds are found near Pretoria, the capital of the province and the administrative capital of the Union of South Africa. Coal, tin, iron, copper, lead, silver, asbestos, and manganese are also mined. Steel is manufactured at Pretoria.

In the northern part of the Transvaal the tableland drops to a lower level and mountains rise in the east. Summer heat is more intense and rainfall is scant. This region is thinly populated in comparison with the central and southern parts of the province. Along the northeastern border is Kruger National Park, a great game reserve covering 8,000 square miles.

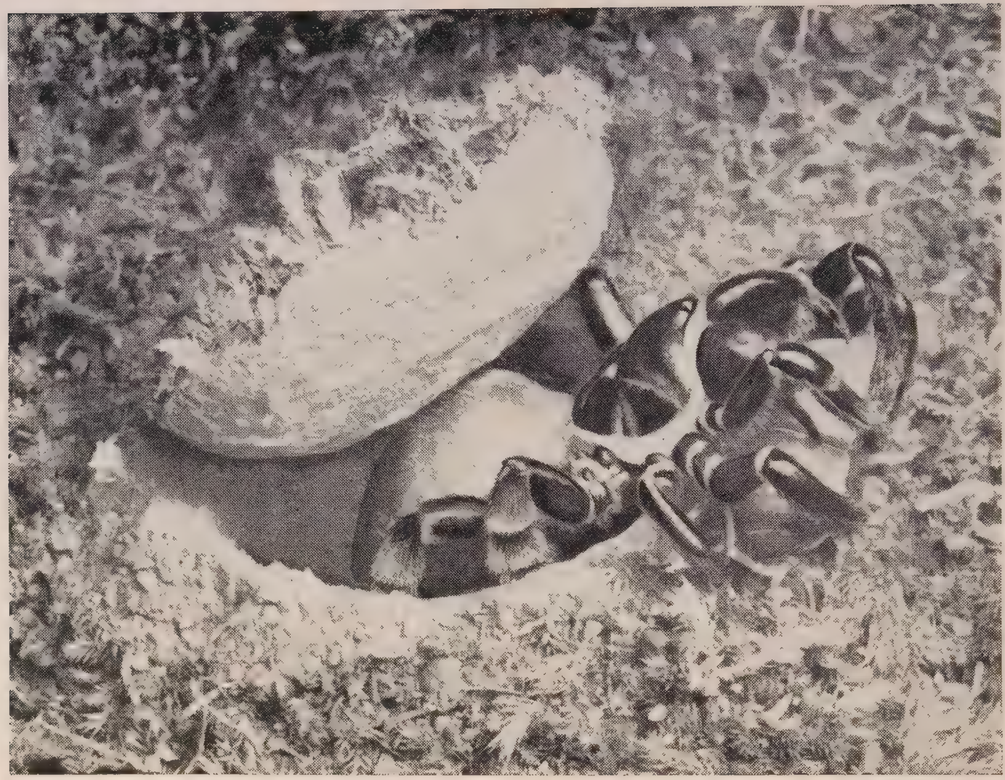
The People. The Transvaal has a population of about 4,185,000, including more than a million persons of European descent. The natives belong to various Bantu tribes; among the Europeans the English are outnumbered by the Boers, whose ancestors came originally from the Netherlands and whose native tongue is Afrikaans, a form of Dutch. Both English and Afrikaans are recognized as official languages. Political affairs are handled by an elected council and an administrator appointed for a five-year term by the Union's Governor-General.

History. Dutch colonists, seeking to escape from British rule in the Cape Colony, made the Great Trek into the Transvaal in the 1830's and set up an independent republic. Incessant warfare with the native tribes eventually forced the settlers to accept British protection in 1877, but four years later the Boers revolted and established the South African Republic. After the discovery of gold, thousands of *uitlanders* (outlanders, or foreigners) streamed into the Rand, and friction between the British and the Boers increased. Disputes led to the Boer War, which broke out in 1899, and




South Africa Railways

FROM THE PREMIER MINE near Pretoria in the Transvaal came the famous Cullinan, largest diamond of gem quality ever found.



Lee Passmore Photo

REACHING OUT FROM UNDER THE RAISED DOOR of its burrow, a trap-door spider captures a sow bug.

in 1900 the Transvaal was annexed by the British. In 1910 it became one of the self-governing provinces of the Union of South Africa. See also JOHANNESBURG; PRETORIA; UNION OF SOUTH AFRICA.

TRANSYLVANIA, *tran sil va'nih uh.* See RUMANIA.

TRAP-DOOR SPIDER, a large, burrowing spider inhabiting the temperate and tropical areas of the world. The various species of trap-door spiders, all harmless to man, dig tubelike dwellings in the ground, reaching slightly less than a foot in length and an inch in diameter. Each burrow is lined with silk spun by the spider and is equipped with a hinged door at the surface. The tightly fitting door, which is constructed of mud and silk, is sometimes camouflaged with moss on the outside so that it is scarcely noticeable. Only one spider inhabits each burrow. Here the eggs are laid and hatched, the young remaining with the mother for about eight months before leaving to establish their own burrows. The trap-door spider feeds on crawling insects and other small invertebrates. When it detects an insect approaching the burrow, the spider pushes back the door and, after reaching out and sinking its poison fangs into the insect, drags the victim into the nest for a leisurely meal. If the spider is alarmed in any way, it will hold the door shut from the inside with its fangs.

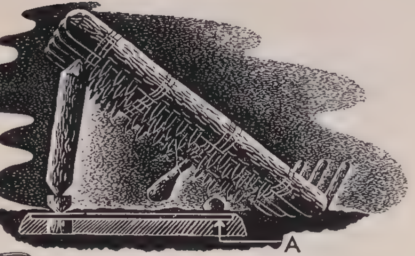
Scientific Name. Common California trap-door spider, *Cteniza californica.*

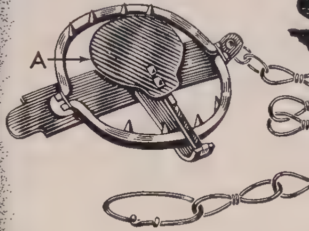
TRAP'EZOID. See QUADRILATERAL.

TRAPPING, the art of catching or killing men and animals by means of devices which they themselves put into operation. Its purposes are to obtain food, to procure pelts, to destroy predators and pests, to obtain zoological specimens, to catch animals for transplantation to other areas, and to catch or kill human enemies.

Traps. Most traps are mechanically operated, the trap being sprung when a prop or trigger device is moved, but there are exceptions such as pitfalls, lobster pots, gill nets, and flypaper. The pitfall is merely a pit covered with light branches and other materials so as to give the appearance of undisturbed ground. The victim is plunged into the pit by its own weight. The pitfall is one of a large number of *enclosure* traps, which imprison victims without injuring them. These traps are usually cages of one kind or another, sometimes equipped with

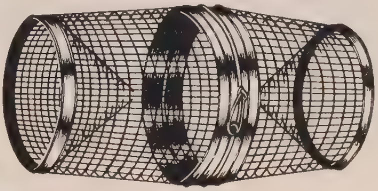
To reach the bait under the deadfall (right) the tiger must step on the hidden lever (A). The props are then upset, and the logs crash down.

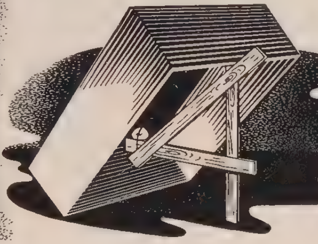




This steel trap (left) is meant for beavers, though raccoons and other animals may be taken in it. Its jaws snap together when an animal steps on the pan (A).

The minnow trap (right) is baited with bread. The fish are guided in by the cones at the ends of the trap, but they are unable to find their way out.





The figure-four trigger (left) is used here to trap a squirrel. When the squirrel tries to take the nut on the end of the crossbar, the sticks come apart and the box falls over it.

doors that close when a prop or trigger is moved, sometimes having mazelike entrances which the victims can easily enter but through which they cannot escape. A common type of cage trap has a falling door which slides into place when the victim moves a figure-four trigger device; this consists of three sticks that are notched so as to fit together in the form of a figure 4. Bait is usually attached to one end of the horizontal bar, and the door or other trapping instrument is supported on or suspended from the upper end of the angled crosspiece. When the bait is moved, the notched pieces fall apart and the movable parts of the trap, no longer held in place, are set in motion. This device is used in many kinds of traps.

The lobster pot is representative of a number of cage traps of the maze type. The lobster can easily pass through the wide-mouthed, funneled entrance but cannot find the small hole to escape from the trap. Fish, turtles, birds, and flies are taken in similar traps. A related trap for birds is a wire-covered cage with small holes in the top. The birds can enter the holes with their wings folded, but they cannot fly out through them. In net trapping, a net is spread on the ground and attached to a bent sapling held in position by a notched stake. When the victim springs the trap, the sapling whips erect and draws the net about it.

Arresting traps, such as the professional steel trap, seize and hold victims by physical force. This steel trap has two jaws, toothed or untoothed, which snap together when the victim steps on a central pan. It is an inhumane device, but it is in wide use because it is easily portable, highly efficient, and can be quickly set and easily concealed. It may be equipped with a jumping mechanism that catches the victim well up on the leg and hence keeps it from twisting or gnawing off a foot. The steel trap appears to have been originally used to trap human poachers and trespassers, but it is now used for animals of all kinds, from birds to bears.

The pitfall armed with spears or sharp stakes was probably one of the earliest of *killing* traps. The deadfall also has a very long history. It consists of heavy logs or rocks which crush the victim when a supporting piece is moved. A modern adaptation of the deadfall is the common mousetrap. Another is a trap with a striking bar operated by a powerful spring, which was devised to supplant the steel trap. A variation of the deadfall is a trap armed with a spear or knife, which pierces the victim when the trap is sprung.

The spring bow, another killing trap, is set to discharge an arrow at the victim. A similar device is a knife attached to a springy branch, so set that it will whip forward and stab the victim. A modern adaptation of the spring bow is the spring gun, which is set to fire when a window or door is opened or when weight is applied to or removed from a certain point. Another application is the booby trap of modern warfare, which is set to fire an explosive when pressure is applied to or relieved from a trigger device.

Snares of wire, rope, and other flexible materials are widely used as killing traps. They may be set on runways or at the entrances to dens and burrows, so that the victims blunder into them, or they may be tied to bent branches or saplings which straighten and draw the noose tight when the victim, enticed by bait, springs the trap. The gill-net principle was used by North American Indians to trap ducks. A small-meshed net was spread under water so that the ducks would push their heads through the meshes while feeding and drown before they could withdraw them.

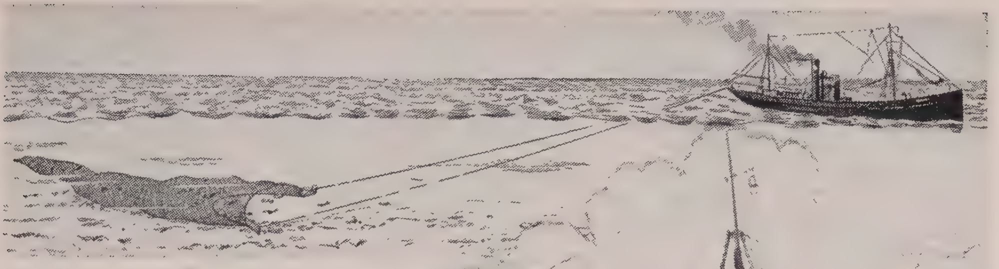
Principles of Trapping. The basic principle of trapping is to victimize animals by their own weaknesses. Any habit or characteristic may be used as a weakness, such as the tendency of many animals to use certain runways. Fox trappers take advantage of the animal's custom of traveling along ridges and springing on mounds and other elevated places, and at times they make use of its curiosity, which sometimes is strong enough to overcome its caution. Some tropical peoples, knowing the greed of monkeys, trap them by making a small hole in a gourd and placing bait within it. The monkey can get its paw through the hole but cannot withdraw it while clutching the bait. When the monkey reaches for the bait, the trapper has only to walk over and capture it, for the monkey is too greedy to release the bait. Trappers of mountain lions and other members of the cat family make use of their craving for catnip. The habit of predators of returning to the remains of their kill is often employed to trap them. "Scents" made of muskrat glands, the castoreum glands of beavers, decayed fish and flesh, and strong-smelling herbs are used to lure some kinds of animals to traps.

Although all animals have frailties by which they may be trapped, some possess sharp senses and an "intelligence" that guard them from all but the most artful traps. Those who trap foxes and wolves use extreme measures to conceal traps and all evidences of the presence of human beings in the trapped area. They approach the area in scented boots, handle all equipment with scented gloves, and kneel on a tarpaulin while setting the traps. They set the traps under the surface of the soil, and, since newly turned earth might arouse suspicion, usually line the excavation with dust before setting the trap, sprinkle dust over the covering of tissue paper or other substance, and carry away the soil removed in digging the holes. See also FUR AND FUR TRADE.

TRAP'PISTS, the popular name of the Order of Cistercians of the Strict Observance, an extremely strict order of monks of the Roman Catholic Church. The order began in 1664 with a reform of the Cistercian monastery at La Trappe, France. The Trappists were separated from the Cistercians of the Common Observance in 1892. Today there are Trappist monasteries in many lands, including the United States. The Trappist's day is divided into periods of meditation and prayer, study, and manual labor. He lives under a rule of perpetual silence, never talking with any of his fellows except the superiors of the monastery. He sleeps in his habit in a bare little cell and, except when he is ill, never touches meat, eggs, or fish.

TRAP'SHOOTING, a sport for shotgunners, originally consisted in shooting at live pigeons as they were released from traps. In the United States and most other countries only the name of this cruel sport survives. The "trap" is a catapult. The "pigeon" is a saucer-shaped target of pitch and gypsum or some other easily breakable substance and is four and one-half inches in diameter. The contestants stand from sixteen to twenty-five yards away and try to break the targets as they fly through the air at different angles.

TRAVELERS AID, a social agency that maintains a desk in almost every large transportation center in the United States in order to provide help to travelers who are inexperienced, handicapped, or in some difficulty. The representative of the Travelers Aid gives travel information, helps travelers to get in touch with friends or relatives, answers inquiries about local conditions, and refers the traveler who is in difficulty to the proper source for assistance. The Travelers Aid is directed by professional social workers, who are assisted by volunteers. The local Travelers Aid Society is usually supported by donations made to the Community Chest or Community Fund. The National Travelers Aid Association, with headquarters in New York



Above, a trawler dragging its baglike net along the smooth, sandy sea-bottom of the continental shelf, where the water is rarely more than 100 fathoms deep. Below, a typical British steam trawler, about 120 feet long. Trawling is most common in the North Sea and on the Grand Banks of Newfoundland, where deep-sea fish are abundant.

City, is the co-ordinating body of the local societies. During wartime the Travelers Aid makes special efforts to help traveling servicemen and their families.

TRAVELER'S CHECK, a check issued in printed form by a bank, an express company, or a travel agency, for the convenience of travelers. These checks, which can be bought in denominations ranging from ten dollars to two hundred dollars, are safe and easily negotiable, for the company which issues them guarantees repayment to the person who accepts them and also protects the purchaser against loss if they are stolen or lost. The buyer pays the full value of the checks plus a small commission based on the total amount of the purchase. When he makes the purchase he signs his name in the space provided in the upper-left corner of each check, and at the time he cashes it he must sign it again, in the lower-left corner. Traveler's checks may be issued in American dollars or in some other national currency.

TRAVERTINE, *trav′ur tin,* a crystalline rock formed by the deposit of carbonate of lime (calcium carbonate, $CaCO_3$) from the fresh water of streams and springs in limestone regions, and from warm springs in regions of present or past volcanic activity. Impurities may change the naturally white color of the rock to cream, buff, or other tints. Many of the finest buildings of ancient and modern Rome are built of this porous, but durable, stone quarried from widespread and thick deposits along the Anio River near Tivoli. At Mammoth Hot Springs in Yellowstone National Park, travertine is now being deposited; older deposits are found in Mexico, Florida, Colorado, and California. Travertine from a quarry at Gardiner, Mont., is used for walls and decoration in many public buildings. An attractively tinted and banded ornamental stone that takes a high polish is called *Mexican onyx.* It is not true onyx, but a translucent variety of travertine that is deposited from springs and also occurs as dripstone in caves.

TRAVOIS, *tra voi′.* See INDIANS, AMERICAN.

TRAWLING, catching fish either in dragnets or by means of long lines, sometimes more than a mile in length, to which baited hooks are attached by short pieces of line. Trawling is used chiefly in the North Sea and on the Grand Banks of Newfoundland. Almost all trawling is now done with an *otter trawl,* a conical net with a wide mouth that is kept open by water pressure on two kitelike otter boards, or trawl boards, as the net is dragged across the bottom of the ocean. Trawl-line fishing, described in Kipling's *Captains Courageous,* was formerly the chief method of fishing on the Grand Banks, but is now little used. Steam trawlers and motor vessels have largely replaced the schooners formerly used in trawling. Some trawlers are now equipped as processing plants. Their catches are brought in as packaged frozen-fish fillets. See also FISH.

TREAD′MILL, a primitive device for using human and animal power to operate machinery. It consists of an endless belt, wheel, or cylinder, set with treads and attached by gears or belting to the machinery to be operated. As men or animals walk on the treads, the belt turns and the machinery is set in motion. Treadmills have been used to propel boats and land vehicles, to elevate

JUST EAST OF THE WHITE HOUSE IN WASHINGTON, D. C., stands the Treasury Building, built in the period between 1838 and 1842. An annex was erected north of the main building in 1919.

irrigation water, to grind grain, and to operate threshers and other machines. They were formerly used as an instrument of punishment in British prisons, and they are still employed to perform necessary work in some Asiatic countries.

TREASON, *tre'z'n,* a crime of disloyalty against the safety of the state. In the days of royalty it included many crimes against the king's authority, and in England it still includes offenses against the sovereign. Treason now is usually limited to actions which endanger the state or the government, such as leading an armed uprising or joining a foreign attacker; but under dictatorships it includes criticism of the dictator. Treason has always been regarded as one of the worst of crimes, meriting the most drastic punishment. Until modern times the traitor was usually put to death with great cruelty.

The United States Constitution (Art. III, Sec. 3) states: "Treason against the United States shall consist only in levying war against them, or in adhering to their enemies, giving them aid and comfort. No person shall be convicted of treason unless on the testimony of two witnesses to the same overt act, or on confession in open court." Only a few Americans have been convicted of treason, and no one has been condemned to death. After World War II several persons were convicted of giving aid to Nazi Germany. Less extreme actions of disloyalty in the United States may be punished under the laws of sedition, espionage, and sabotage (see SABOTAGE; SEDITION; SPY). In Canada, Louis Riel was hanged as a traitor in 1885 for leading a rebellion in Saskatchewan (see SASKATCHEWAN REBELLION).

TREASURY, *trezh'ur ih,* DEPARTMENT OF THE, one of the principal executive departments of the United States Government, was created by act of Congress on September 2, 1789. Under this act, the Secretary of the Treasury was charged with the duty of superintending and managing the public finances, maintaining public credit, and organizing a system of public accounting. Alexander Hamilton, the first Secretary of the Treasury, was one of many distinguished men who have held this office.

In the course of time many other acts of Congress increased the scope of the Treasury in order to keep pace with the rapid development of the nation. The Treasury Department now includes the Bureau of the Mint, the Bureau of Engraving and Printing, the Bureau of Internal Revenue, the Bureau of Customs, the Bureau of Narcotics, the United States Secret Service, the Bureau of the Public Debt, the Office of the Comptroller of the Currency, the Office of the Treasurer of the United States, the Bureau of Accounts, the United States Savings Bond Division, and, except in time of war, the United States Coast Guard.

The Bureau of the Mint handles the coinage of money; the Bureau of Engraving and Printing prints paper money, bonds, and notes (and also all kinds of stamps, government checks, and forms). The Secret Service is especially concerned with the prevention of counterfeiting. The Bureau of Customs, the Bureau of Narcotics, and the Coast Guard, in addition to their other functions, share responsibility in the control of smuggling.

The Secretary of the Treasury, who heads the department, is a member of the President's Cabinet and is next to the Secretary of State in the line of succession to the Presidency. One of the duties of the Secretary is to suggest fiscal policies. He is assisted by an Under Secretary and two Assistant Secretaries, a General Counsel, and a technical staff. The Secretary is, by reason of his office, a member of many important agencies and offices. He is the United States governor of the International Monetary Fund and the International Bank for Reconstruction and Development, and he serves as trustee of the Federal Old-Age and Survivors Insurance Trust Fund.

The Comptroller of the Currency has general supervision over the national banks, which are visited by examiners from the Treasury at least twice each year.

The Treasurer of the United States is the official custodian of the public funds and securities. The Office of the Treasurer of the United States, which was created by the Act of September 2, 1789, became part of the Fiscal Service of the Treasury in 1940. This office receives and disburses public moneys and generally acts as banker for the Federal Government. See also COAST GUARD; CUSTOMS DUTIES; MINT; MONEY; SECRET SERVICE, UNITED STATES.

TREATY, an agreement or contract between two or more independent nations, formally signed by official representatives of the nations taking part, and ratified, or approved, by the national governments according to their laws. In the United States, for example, the Senate must ratify all treaties. National laws make citizens do certain things and forbid them to do certain other things; in international law, treaties have the same purpose. A nation which signs a treaty agrees to follow the rules the treaty sets forth, just as a person becoming a citizen agrees to abide by the laws of the nation. See CIVIL LAW; CONTRACT; INTERNATIONAL LAW; STATUTE.

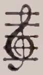
Treaties are of many different kinds. Political treaties include not only those which deal with the terms of peace which end a war but also those dealing with *alliances* (two or more countries agreeing to support each other in case of war), *arbitration* (the settlement of disputes between countries by a third party), and the *cession,* or giving up, of territory by one country to another. Commercial treaties deal with trade, tariffs, navigation, and fishing rights. Other classes of treaties are concerned with patents, copyrights, trademarks, postal rights, rules of international law, and the return of criminals from the country in which they have taken refuge to the country where they are wanted for their crimes.

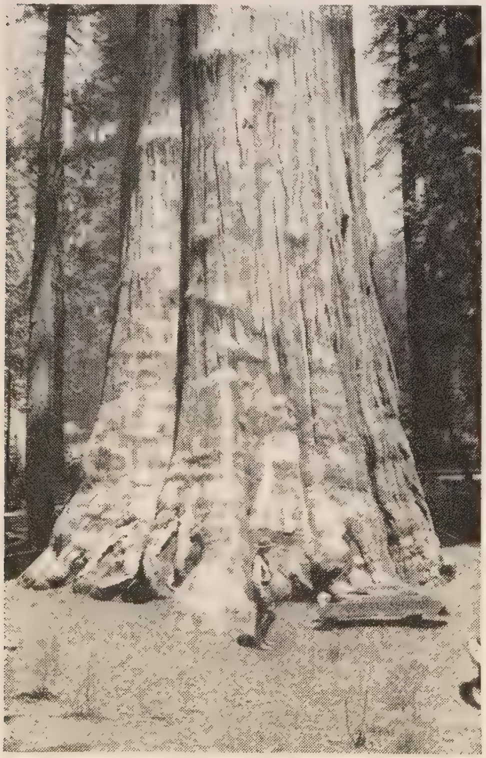
Treaties may be arranged either by regular diplomatic agents, such as ambassadors, or by special commissioners. Treaties in which more than two countries take part are usually drawn up in conferences by delegates who then turn them over to their governments for ratification. Once they are ratified, the nations must abide by them during the period for which the treaties are in force. Of course, some nations break treaties, just as some citizens break the law. When one nation refuses to abide by a treaty, other nations that have signed the treaty need no longer abide by it. When two nations go to war with each other, any treaties between the two cease to be in force.

In the days when most countries were monarchies, all treaties were made and ratified by kings, and even today all treaties in which Great Britain takes part are made in the name of Britain's monarch. In the United States, according to the Constitution, the President has the power to make treaties, "with the advice and consent of the Senate." But all treaties arranged by the President must be approved by two thirds of the Senators present before they become binding for the United States. The Charter of the United Nations provides that "every treaty . . . entered into by any member of the United Nations . . . shall as soon as possible be registered with the Secretariat and published by it."

Related Articles. For information on notable treaties described in these volumes, consult the following titles:

- Aix-la-Chapelle, Treaties of
- Berlin, Congress of
- Clayton-Bulwer Treaty
- Ghent, Treaty of
- Guadalupe Hidalgo, Treaty of
- Hay-Pauncefote Treaty
- Jay's Treaty
- Paris, Treaties of
- Ryswick, Treaty of
- Utrecht, Peace of
- Versailles, Treaty of
- Washington, Treaty of
- Webster-Ashburton Treaty
- Westphalia, Peace of

TREBLE, *treb''l,* the highest vocal or instrumental part in a musical composition. The parts sung by women or children, or played by high-pitched instruments like the violin, the flute, or the clarinet, and the higher notes of the piano and the organ are in the treble. The treble clef , a sign used at the beginning of a musical staff, indicates that the note on the second line of the staff is G above middle C.



Pan American Airways System

LARGEST OF LIVING THINGS and one of the oldest, the enormous sequoia General Sherman, in California's Sequoia National Park, has branches which are larger than most other trees.

TREE, a woody perennial plant. Trees, the largest of all plants, provide man with lumber and many other wood products and with a variety of fruits. They form our forests and our orchard groves and often line our streets, giving protection from both sun and shower. Besides their great usefulness, trees are prized for their beauty.

A tree usually has a single main stem, called a *trunk* or *bole,* which distinguishes it from a shrub or bush. But under certain conditions, as when their main stems are broken when young, many kinds of trees branch and rebranch near the ground as shrubs do, and sometimes a clump of large trunks rises from the same roots. Fully grown banyan and mangrove trees always have numerous trunks (see BANYAN; MANGROVE).

Trees are commonly taller than shrubs, but dwarf fruit trees and trees that grow under adverse conditions, such as those that exist at timberline on mountains, grow only a few feet tall. Redwood, eucalyptus, and Douglas-fir trees may attain heights of more than three hundred feet. Great trees such as these and the sequoias are the largest living things in the world. The oldest living things also are trees. Some trees live for only a few years, but some live for hundreds and even thousands of years. The giant sequoias may live as long as four thousand years, and a cypress in Mexico is said to be more than four thousand years of age.

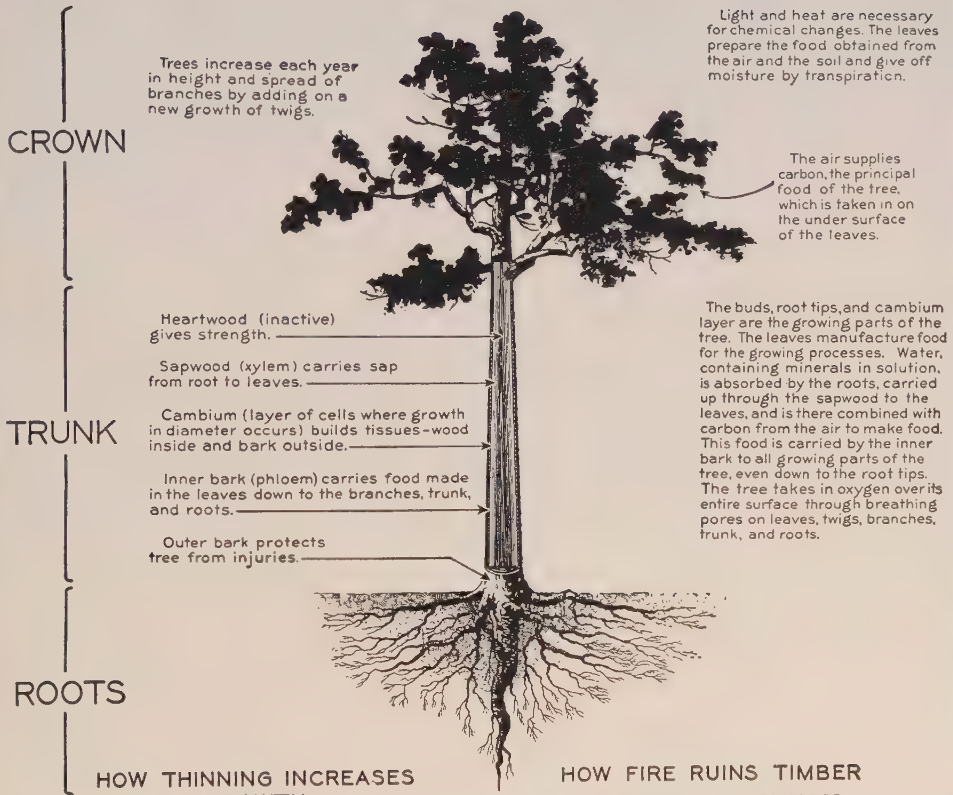
Parts of a Tree. The main parts of a tree are the roots, trunk, and crown of branches and leaves. Its roots anchor it in the soil and supply it with water and dissolved minerals. Its trunk supports the crown and serves as a food and water channel between roots and leaves. Its leaves supply it with food which they make by *photosynthesis;* in this process green plants use the energy of sunlight to make plant food.

Trees have very extensive root systems. The roots usually make up about one tenth of the wood of a tree. In a mature tree they spread at least as far as the branches, often much farther. The roots of a large tree may have a total length of several hundred miles (see ROOTS).

In cone-bearing trees, the trunk usually rises as a tall, undivided column; but in most broad-leaved trees it divides and subdivides into a spreading crown. In forests where they must compete for sunlight, their

HOW A TREE GROWS

Outward and Upward



Trees increase each year in height and spread of branches by adding on a new growth of twigs.

Light and heat are necessary for chemical changes. The leaves prepare the food obtained from the air and the soil and give off moisture by transpiration.

The air supplies carbon, the principal food of the tree, which is taken in on the under surface of the leaves.

Heartwood (inactive) gives strength.

Sapwood (xylem) carries sap from root to leaves.

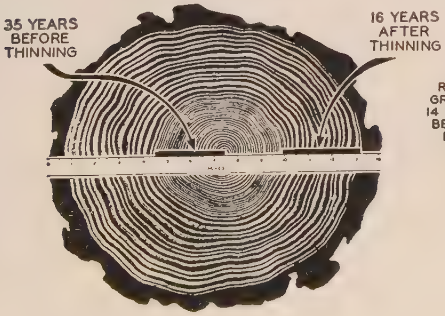
Cambium (layer of cells where growth in diameter occurs) builds tissues—wood inside and bark outside.

Inner bark (phloem) carries food made in the leaves down to the branches, trunk, and roots.

Outer bark protects tree from injuries.

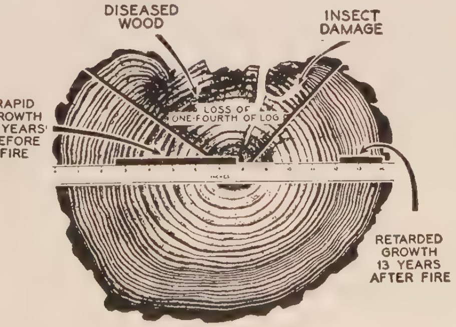
The buds, root tips, and cambium layer are the growing parts of the tree. The leaves manufacture food for the growing processes. Water, containing minerals in solution, is absorbed by the roots, carried up through the sapwood to the leaves, and is there combined with carbon from the air to make food. This food is carried by the inner bark to all growing parts of the tree, even down to the root tips. The tree takes in oxygen over its entire surface through breathing pores on leaves, twigs, branches, trunk, and roots.

HOW THINNING INCREASES GROWTH

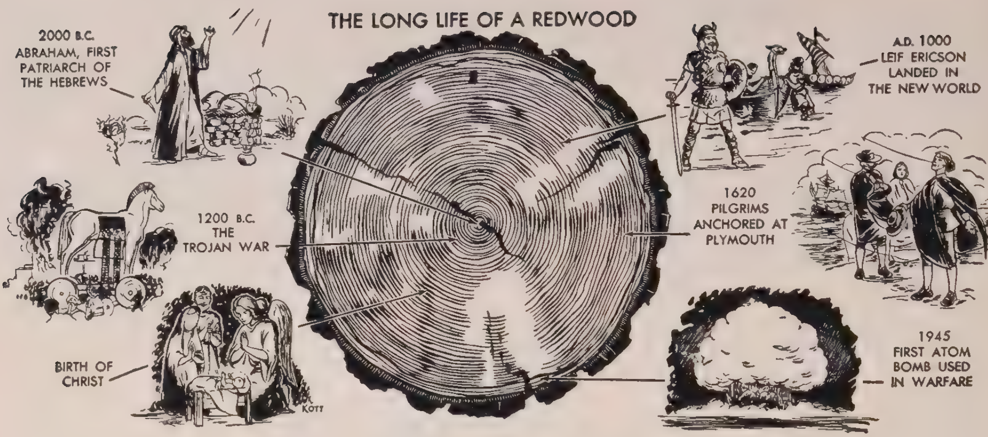


HOW FIRE RUINS TIMBER

DISEASE AND INSECTS ENTER THROUGH FIRE SCARS


DISEASED WOOD
INSECT DAMAGE
RAPID GROWTH 14 YEARS BEFORE FIRE
LOSS OF ONE-FOURTH OF LOG
INCHES
RETARDED GROWTH 13 YEARS AFTER FIRE

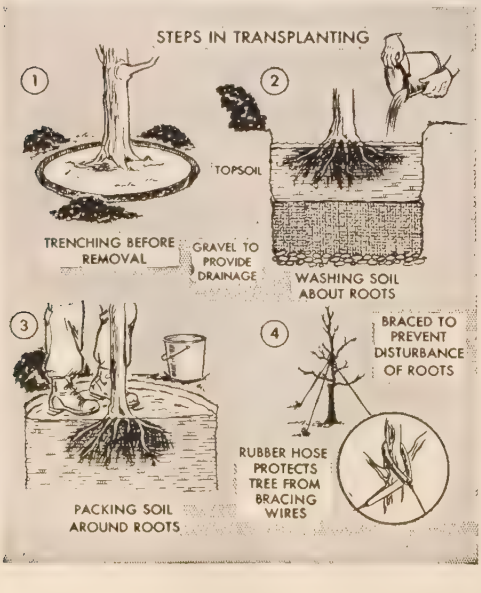
Courtesy U.S. Forest Service


THE LONG LIFE OF A REDWOOD
2000 B.C.
ABRAHAM, FIRST PATRIARCH OF THE HEBREWS
1200 B.C.
THE TROJAN WAR
BIRTH OF CHRIST
A.D. 1000
LEIF ERICSON LANDED IN THE NEW WORLD
1620
PILGRIMS ANCHORED AT PLYMOUTH
1945
FIRST ATOM BOMB USED IN WARFARE
KOTT

A SAPLING IN THE DAYS OF ABRAHAM, this redwood still lives in the time of the atomic bomb.

trunks grow taller before branching and their tops are less rounded than when they grow in the open.

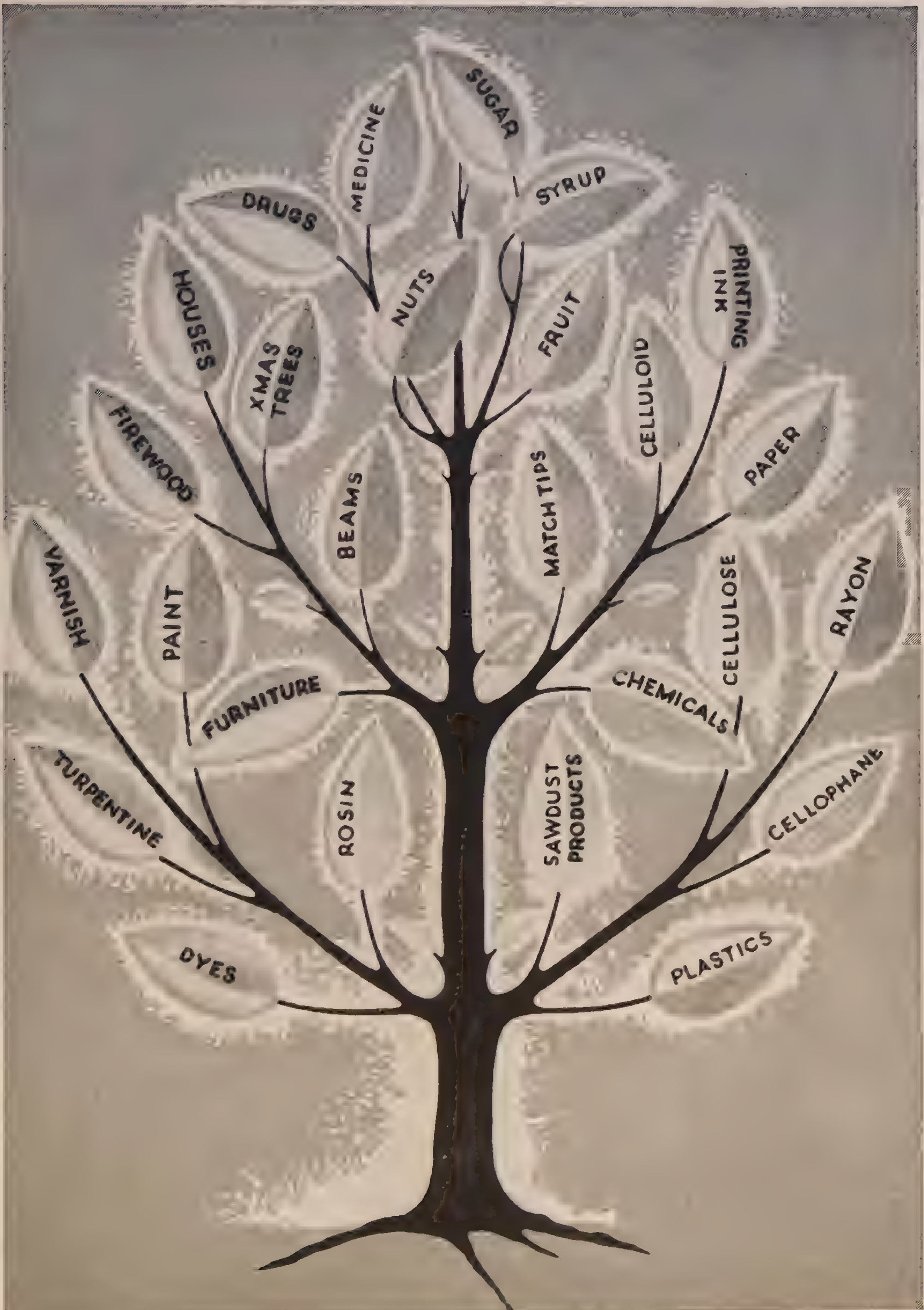
In the center of the trunk and branches of trees is a slender column of spongy tissue called *pith*. In young trees this is surrounded by the sapwood, or *xylem*, through which water and mineral solutions travel from the roots to the leaves. As trees age, the sapwood, starting in the center, is stiffened and hardened by a material called *lignin* and by other substances. It then becomes heartwood, which does not serve in nourishing the tree but which usually adds greatly to its strength. The sapwood is surrounded by the *cambium*, a layer of cells through which the tree grows in circumference. The cells produced by the cambium in spring (in temperate areas), when moisture is plentiful, are large, thin-walled, and light in color. The wood cells formed later in the season are smaller and darker. The bands of light and dark wood thus formed during each growing season constitute an *annual ring*. By counting the annual rings, either in a cross section of the trunk or in a boring taken through the trunk, it is often possible to determine the age of a tree. Sometimes it is possible also to ascertain such things as weather conditions during certain years from the condition of the rings (see STEMS).


STEPS IN TRANSPLANTING
①
TRENCHING BEFORE REMOVAL
②
TOPSOIL
GRAVEL TO PROVIDE DRAINAGE
WASHING SOIL ABOUT ROOTS
③
PACKING SOIL AROUND ROOTS
④
BRACED TO PREVENT DISTURBANCE OF ROOTS
RUBBER HOSE PROTECTS TREE FROM BRACING WIRES

The inner bark, the *phloem*, which surrounds the cambium, carries nutrients from the leaves to other parts of the tree. The dead corky cells of the outer bark protect the living cells from damage (see BARK).

The branches and twigs hold the leaves out to the sunlight, which supplies the energy from which the leaves convert carbon dioxide and minerals into plant nutrients (photosynthesis). A large food factory is required to furnish the food needed by a large tree. A mature pine tree may have a total leaf surface of more than thirty square miles, and a large broad-leaved tree may have an even greater leaf surface. Not only oxygen but also water is given off through small openings called *stomata*, and in great quantities. By evaporation, or *transpiration*, a large apple tree may give off almost one hundred gallons of water in a single day (see LEAVES).

Evergreen and Deciduous Trees. Almost all conifers — larches and bald cypresses are exceptions — are evergreens. They do not renew and lose their foliage yearly. When their old leaves die, usually after three or four years, they are replaced by new ones. In the tropics almost all trees are evergreens. In temperate areas, also, a number of broadleaf trees, such as holly and rhododendron, retain their leaves throughout the year. But most broadleaf trees in



[illegible] erine Glover; Row, Pe[illegible]

THE LABELS ON THE LEAVES of the tree in this diagram name some of the many useful products partly or wholly provided by trees.

temperate and colder areas are deciduous; that is, they shed their leaves in fall or winter and produce new ones in spring. If they were to retain their leaves throughout the winter, transpiration would proceed more rapidly than the roots could obtain moisture from the frozen soil, and the trees would die of thirst (see DECIDUOUS PLANTS).

The leaves of deciduous trees do not break off haphazardly. Long before they fall, a layer of cells called *abscission cells* develops across the base of each leafstalk, sometimes across the bases of twigs. These cells gradually soften and separate. At the same time a layer of corky cells begins to form a scar across the base of the leafstalk, sealing the wound before the leaf breaks away. Finally the leaf is attached only by the vascular tissue through which liquids pass between leaf and stem, and which is eventually broken by wind, rain, and frost.

The beautiful coloration of deciduous leaves in fall is not caused by frost, though frost may have an influence in making certain colors more vivid. The colors exist in the leaves throughout the year, and they may be seen if a tree or branch is killed in midsummer; but until fall they are usually masked by the green chlorophyll in the leaves (see CHLOROPHYLL). As the tree nears its rest period, it stops producing chlorophyll, and the previously hidden colors appear.

Planting Trees. In selecting trees for planting it is important to choose only those that are adapted to the climatic and other conditions — such as the smoke of cities — prevailing where they are to grow. They should be planted in suitable soil, where there is adequate moisture and good drainage. In humid areas where winters are mild, evergreens may be planted from August through spring, and deciduous trees may be planted from the time their leaves change color until their buds begin to open. In colder, drier areas both evergreens and deciduous trees are preferably planted in spring.

Trees purchased from nurseries are usually properly prepared for planting, with their roots pruned and covered with a ball of soil wrapped in burlap. If trees are to be dug for transplanting, it is well to prune their roots a year before they are to be moved. In pruning the roots a trench of sufficient depth and diameter is dug about the tree. A practical rule for the diameter of the trench is to make it twelve inches wide for trees up to two feet tall and to increase the width by two inches for every additional foot of height. The depth of the trench should be from one half to three fourths of its diameter. When the roots are thus pruned the tree is forced to produce a bushy growth of feeder roots in order to sustain itself, and these roots make it easier for the tree to establish itself in its new location. When the tree is to be moved, it is necessary only to dig under it to remove it with the ball of soil in which the roots are growing. The ball of soil prevents the hairlike feeder roots from drying out.

The hole for the tree should be dug wider and deeper than necessary to hold its roots. Good topsoil should then be tamped in the hole to a height sufficient to hold the tree at the depth at which it originally grew. Topsoil, preferably mixed with about one third peat moss or other humus, should then be carefully packed about the roots, care being taken not to leave any air spaces about the roots. When the hole is somewhat more than half-full, water should be poured in to ensure firm settling of the soil about the roots. The soil about the tree should form a shallow depression, so that water will run toward the tree.

About one half of the tops of the deciduous trees should be pruned in order to reduce transpiration and lessen the burden on the roots. Only the lateral branches should be pruned. The leader, by which the tree grows upward, should not be cut. Conifers should not be cut back, and it is important to prevent damage to the tips of their leaders.

Trees several feet tall should be supported by guy wires in order to prevent movement of their roots in the soil. A pad of rubber, cloth, or some other substance should be placed between wire and tree so as to prevent the wire from cutting into the bark.

Uses of Trees. Trees have innumerable uses for mankind. They furnish us with such foods as nuts, fruits, maple syrup, and chocolate, with spices such as cinnamon and nutmeg, and with such drugs as quinine and strychnine. They provide us with rubber, cork, tannin, turpentine, dyes, and gums and resins. Their wood serves as fuel and is made into furniture and many other useful products, including paper, rayon, celluloid, and plastics. They beautify our parks, streets, and homes; and they are vitally important in conserving water and soil and as a habitat for wildlife (see CONSERVATION).

Related Articles. For further information, and for descriptions of individual trees, consult the following titles:

Ailanthus
Alder
Arbor Vitae
Ash
Aspen
Balm of Gilead
Balsa
Balsam Fir
Basswood
Bay
Beech
Birch
Box Elder
Buckthorn
Cacao
Catalpa
Cedar
Chestnut
Conifers
Cork
Cottonwood
Cypress
Elder
Elm

Robert C. Hermes

PERCHED ON A TWIG, THE TREE FROG may suddenly take off in a leap that will carry it twenty times its length. (See next page.)

Eucalyptus
Evergreen
Fir
Forests and Forestry
Fruit (with list)
Hemlock
Holly
Ironwood
Judas Tree
Juniper
Laburnum
Larch
Laurel
Locust
Lumber
Magnolia
Mahogany
Mango
Maple
Mountain Ash
Nut (with list)
Oak
Osage Orange
Palm
Palmetto
Pine
Poplar
Sago
Sassafras
Seeds
Sequoia
Spruce
Sycamore
Tallow Tree
Tamarind
Teak
Tulip Tree
Upas
Willow
Yew

Books for Reading and Reference

COLLINGWOOD, GEORGE HARRIS. *Knowing Your Trees.* American Forestry Association. Photographic illustrations.

HARLOW, WILLIAM MOREHOUSE. *Trees of the Eastern United States and Canada.* Whittlesey. Describes their woodcraft and wildlife uses.

HARRAR, ELWOOD S. and J. GEORGE. *Guide to Southern Trees.* McGraw.

LIMBACH, RUSSELL T. *American Trees.* Random. Profusely illustrated with color pictures and drawings. For young readers.

MCKENNY, MARGARET. *Trees of the Countryside.* Knopf.

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Outline on Trees

I. What a Tree Is
II. Its Parts
  A. Roots
  B. Trunk
  C. Leaves
III. How Trees Grow
IV. How They Keep Alive
V. Evergreens
VI. Deciduous Trees
  A. Why the leaves fall
  B. Why they change color
VII. How to Plant a Tree
VIII. Uses of Trees

TREE FROG, or **TREE TOAD**, a large family of small, tree-dwelling amphibians inhabiting both the Old and New worlds. Most species measure about two inches in length, have a somewhat warty skin, and are equipped with sticky toe discs which enable them to cling to smooth surfaces. They are capable of changing color, ranging through various shades of green, gray, and brown, and thus blend in with their surroundings. Like other frogs, the tree frog catches insect food with its long, sticky tongue and lays its eggs in or near water. At night the male utters a melodious, trilling call by puffing out its throat into a pouchlike sac. Tree frogs are not only valuable as destroyers of harmful insects but also make interesting pets. In captivity they can be fed meal worms or earthworms. See also AMPHIBIANS; FROG.

TREE OF HEAVEN. See AILANTHUS.

TREE TOAD. See TREE FROG.

TRE′FOIL, the general name of several kinds of plants, such as clovers, having compound leaves of three leaflets. *Bird's-foot* trefoil, named for the appearance of its pods, is a shamrocklike plant of the bean family. To the same family belongs the *tick* trefoil, whose hairy seed vessels stick to clothing and the skins of passing animals.

TREM′OR. See PALSY.

TRENCH FOOT, or **IMMERSION**, *ih-mur′shun*, **FOOT**, a condition similar to frostbite, is an important cause of disability among fighting men during wartime. Unlike frostbite, it is not caused simply by freezing temperatures but rather results from prolonged exposure to a cool, damp environment or from actual immersion of the feet in cold water over long periods of time. Nutritional deficiency, chilling of the body, fatigue, and long-continued inactivity may also contribute to the development of the disease. The feet become numb, begin to swell, and are extremely painful. The skin, which is pale or slightly red at first, changes to a mottled yellowish or blue color. Swelling and pain continue, blisters develop, and in severe cases gangrene may develop. The treatment of trench foot consists in bed rest, the administration of heparin or other drugs to prevent blood clotting, the use of procaine to deaden pain and increase circulation, and exposure of the feet to air, beginning with a low temperature and gradually increasing it as circulation is restored. The patient is not permitted to smoke, since tobacco causes the blood vessels to contract and therefore interferes with circulation.

TRENCH MOUTH, or **VIN′CENT'S DISEASE**, an inflammation of the mouth and gums caused by two kinds of micro-organisms — a bacillus and a spirochete. Trench mouth, so called from its prevalence among the soldiers of World War I, sometimes occurs in epidemic form and is common wherever people are crowded together under unsanitary conditions. Frequently it is spread from person to person by means of contaminated food utensils. The mouth and gums become swollen, red, and painful, ulcers form, and bleeding gums may develop. These symptoms are sometimes accompanied by fever and loss of appetite. Treatment with penicillin usually brings a speedy recovery.

TRENT, COUNCIL OF, a famous council of representatives of the Roman Catholic Church which met at Trent, in northern Italy, in three sessions from 1545 to 1563. The Council was established by Pope Paul III because of the split in the Church which had been brought about by the Protestant Reformation. When the Council met there was hope that it might bring the Protestants and Catholics together again and also, through reforms, put an end to many abuses of Church principles. The meetings were interrupted several times by political and religious disturbances. The Council brought about many reforms, defined many of the great Catholic doctrines, strengthened the supremacy of the pope, and unified the faithful of the Church. Yet it did not bring back the Protestants, and the break between Protestants and Catholics became permanent. See also COUNTER-REFORMATION.

TRENT AFFAIR, an incident of the War between the States, important because it involved a principle of international law and because it brought Great Britain nearly to the verge of war with the United States. On November 8, 1861, Captain Charles Wilkes, commanding the USS "San Jacinto," intercepted the British mail ship "Trent" at sea and searched it. Two Confederate commissioners, John Slidell and James M. Mason, who were on their way to Europe to seek support for the Confederate cause, were seized and taken to Boston as prisoners. According to international law, Captain Wilkes should have taken the "Trent" to a port and asked a prize court to decide whether the transportation of the commissioners was a violation of neutrality. Although the North was enthusiastic over the seizure of the two men, indignation over the incident roused the British Government to strong protest, and feeling in England ran high. President Lincoln and Secretary of State Seward, realizing that search and seizure at sea violated the principle of freedom of the seas, ordered the commissioners released and sent formal apologies to Great Britain.

TRENTON, BATTLE OF, an important battle of the Revolutionary War, was fought at Trenton, N. J., on December 26, 1776. General Washington, who had retreated

Courtesy of Yale University Art Gallery

IN JOHN TRUMBULL'S PAINTING of the capture of the Hessians at Trenton, Washington, the central figure, is speaking to the wounded Hessian officer held by the General's aide.

across the Delaware River into Pennsylvania under pressure from the British, lacked supplies, and many of his men were close to the end of their enlistment period. A victory was urgently needed, and Washington, knowing that about 1,500 Hessian soldiers were stationed at Trenton, decided on a surprise attack. With about 2,500 men, he recrossed the Delaware on Christmas night, at McKonkey's Ferry, about eight miles north of Trenton. In an early morning storm the Americans surprised the Hessians, who had spent the night celebrating, and took about 1,000 prisoners at the cost of four men wounded. On January 3, Washington followed this success with a victory over the British at Princeton, and the American cause won a new lease of hope. See also REVOLUTIONARY WAR IN AMERICA.

TRENTON, N. J., the state capital, is an industrial city lying at the head of navigation on the Delaware River, fifty-five miles from New York and thirty miles from Philadelphia. More than three hundred plants in Trenton produce a wide variety of manufactured articles, including pottery famous since colonial times, wire and cable, metal goods, cigars, rubber, and steel. The Marine Terminal handles Delaware River shipping.

A grist mill built in 1679 on Assunpink Creek marked the first settlement in the region. In 1714 William Trent bought and laid out what is now the main section and gave the town his name. The city's place in history was assured when, during the Revolutionary War, Washington made his famous crossing of the Delaware to win two decisive battles at Trenton. Trenton was given consideration as a site for the national capital in 1784, when a session of Congress was held there. Among the many historic landmarks are Ye Olde Barracks, which quartered British soldiers in colonial days and Hessian troops during the Revolution; Trent House, built in 1719; McKonkey's Ferry House and the Bear Tavern; the Old Masonic Temple, which dates from 1793; and a number of early churches. The State House still contains portions of the original structure, which was completed in 1792. Monuments and parks celebrate the historic importance of Trenton. With a population of about 128,000, Trenton ranks fourth among New Jersey cities.

TRENT RIVER, an important river in central England, rises north of Stafford and flows south before swinging to the northeast. Near Hull it unites with the Ouse to form the Humber estuary, through which it empties into the North Sea. The Trent is about 170 miles long, and it is navigable for small vessels as far as Gainsborough. It is used by barges for a much greater distance, and the canal which links it to the Mersey makes it a part of the network of inland waterways in central England. In its upper course the Trent passes through many of the towns where England's famous china is manufactured. Nottingham is one of the principal cities on the Trent.

TREPANG′. See Sea Cucumber.

TREPHINING, *tree fine′ing,* a surgical operation in which a small round hole is cut in a bone. The instrument used in this operation is a circular saw called a *trephine.* Trephining is most often performed on the skull, where one or more small buttons of bone are removed to enable the surgeon to work on the diseased brain. Fossilized human skulls show that primitive man also practiced a crude form of trephining. Because in early times sick persons were believed to be possessed of evil spirits, holes were probably drilled in their skulls to allow the evil spirits to escape.

TRES′PASS, an offense against property, especially entry upon land without consent. Less commonly trespass means a threat or harm to an individual's physical self. For information about this type of offense, see Assault and Battery.

Some common forms of trespass against land are posting advertisements on a person's buildings, entering his house, or allowing livestock to stray across his fields — all done without his permission. When an officer of the law searches a house without the authority of a warrant, he is trespassing. Burglary is a form of trespass against personal property (property which is movable or temporary in nature). A person who trespasses may be sued for damages (see Damages). A property owner may check continued trespass by obtaining an injunction (see Injunction). Also, trespass may be a criminal offense as well as a civil offense (see Tort). Legally, action may be taken in the case of trespass by mistake as well as in the case of willful trespass.

In some versions of the Lord's Prayer, trespass is used in a general way to mean any offense against the moral laws of God and the rights of man.

TRIAL BY BATTLE. See Battle, Trial by.

TRIANGLE, a closed figure with three sides that are straight lines. A figure defined in this way is a *plane* triangle; it can be drawn on a blackboard or on paper lying on a flat surface. Many interesting properties of triangles were known long before Euclid gave logical proofs for them in theorems in his *Elements of Geometry* (see Euclid). Measurement of triangles is the basis of ancient and modern surveying. See Trigonometry.

Two sides of a triangle meet in a point called a *vertex* of the triangle; it is also the vertex of the *angle* between the two sides. Each of the three vertices and three angles of a triangle is opposite one of the sides. It is customary to denote angles and vertices of a triangle by capital letters, and a side by a single small letter or by the two capital letters at its ends. Thus in Fig. 1, one may refer to the vertex *A,* or the angle *A,* of triangle *ABC,* and to side *a* or side *BC.* See Angle.

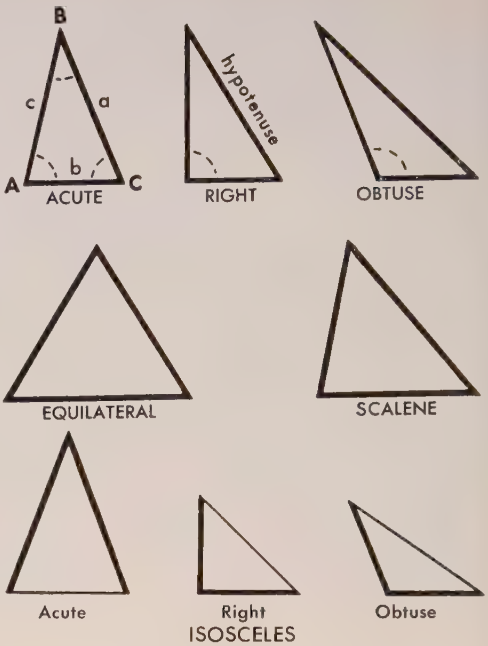


Fig. 1. Classification of Triangles

Classification. A *right* triangle is one that has one right angle (90°); an *obtuse* triangle has one obtuse angle (greater than 90°); and an *acute* triangle has three acute angles, each less than 90°. In a right triangle the side opposite the right angle is called the *hypotenuse* and the other two sides are often called *legs.* When classed according to its sides a triangle is *isosceles* if two of its sides are equal, *equilateral* if all three sides are equal, or *scalene* if all three sides are different in length. Any one triangle may, of course, be classed according to its angles, its sides, or both. For example, all triangles in the first row of Fig. 1 are scalene, those in the second row are acute, and those in the third row isosceles.

Selected Properties. By careful measurement of each angle of a triangle with a pro-

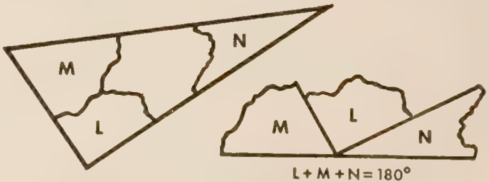


Fig. 2. The sum of the angles of a triangle is two right angles.

tractor it is possible to check this statement: *The sum of the three angles of a triangle is 180°.* Another check is to cut a triangle out of paper, tear off its angles, and add them by placing them side by side with their vertices together, as in Fig. 2.

If two triangles are the same shape and size, so they can be made to coincide exactly, they are said to be *congruent* triangles. The two right triangles obtained by cutting a sheet of letter paper along a diagonal can be shown to be congruent by superposing one on the other so they coincide. In general, *two triangles are congruent if any three of the six parts* (three sides and three angles) *of one triangle, except three angles, are equal to corresponding parts of the other.* Thus any three parts, except three angles, are said to determine the size and shape of a triangle. These three parts may be two sides and the included angle, two angles and the included side, two sides and the angle opposite one of them, two angles and the side opposite one of them, or three sides.

The angles opposite the equal sides of an isosceles triangle are equal. This statement can be checked by measuring the angles with a protractor or by noting that the angles coincide if the triangle is folded so that the equal sides coincide. In the same way it can be shown that an equilateral triangle is also equiangular, each angle being 60°.

The *base* of a triangle may be any one of the three sides, usually the one upon which the triangle seems to rest. The triangle *DEF* in Fig. 3 is shown resting on the side *DF* and also on the side *ED*. The line *EG* is said to be *perpendicular* to the side, or base, *DF* because it makes right angles with *DF;* that is, angle *DGE* is a right angle (90°) and so is angle *FGE*. An *altitude,* or *height,* of a triangle is the perpendicular distance from a vertex of the triangle to the side opposite. Since a triangle has three vertices it also has three altitudes. Thus *EG* is one altitude of triangle *DEF* in Fig. 3, *FH* is a second one, and *DJ* a third. It can be proved that *the three altitudes of a triangle all pass through the same point,* as in Fig. 3. See PYTHAGOREAN THEOREM.

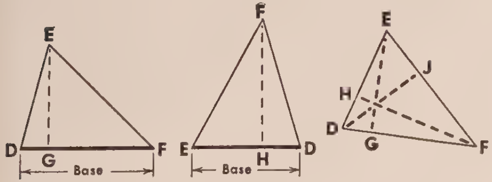


Fig. 3

Rigidity. If four strips of thin wood are fastened with single nails at the corners of a square, as in Fig. 4a, the figure is not rigid but can be made to take a form like that in Fig. 4b, in which the four sides are still equal but the angles are no longer right angles. The shape of a triangle with a given set of sides cannot be changed in this way; to change the shape it is necessary to change the length of one or more sides. Triangles are therefore *rigid* figures and are used to give rigidity to many types of construction, from brackets for supporting shelves (Fig. 4c) to the triangular, or diagonal, bracing found in steel structures like radio towers and bridges.

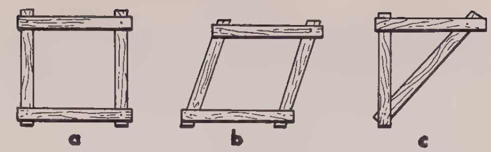


Fig. 4

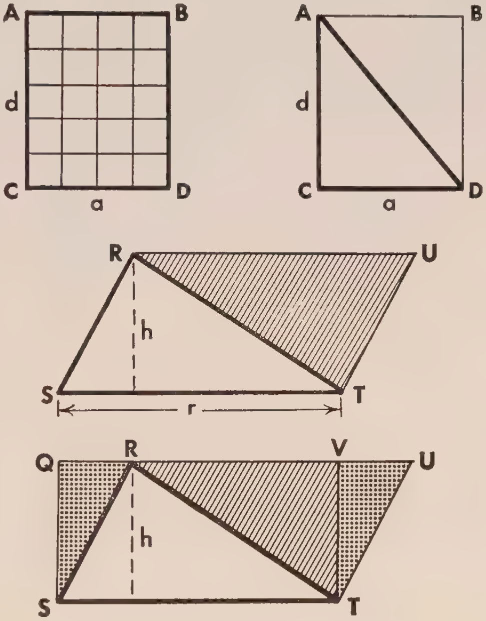


Fig. 5

Area. The area of the rectangle *ABCD* in Fig. 5 is the product of its width *a* by its height *d*. The diagonal *AD* divides the figure into two equal right triangles, each of which therefore has half the area of the rectangle. Thus the right triangle *ACD*, with base *a* and height *d,* has an area ½*ad*. In general, *the area of any triangle is equal to one half the product of its base by its height;* that is, it is half the area of a rectangle that has the same base and height as the triangle. For example, it can be seen that triangle *RST* in Fig. 5, with base *r* and height *h,* is equal (congruent) to triangle *TUR* and hence has half the area of the figure *RSTU*.

But *RSTU* has the same area as the rectangle *QSTV;* hence the area of triangle *RST* is half the area of rectangle *QSTV,* that is, it is ½*rh.*

Similar Triangles. The shape of a triangle depends upon the sizes of its angles. If three angles of one triangle are equal to the three angles of another, the triangles have the same shape and are said to be *similar.* Triangles *ABC* and *A′ B′ C′* in Fig. 6 are similar, having angles *A* and *A′* equal, as well as *B* and *B′* and *C* and *C′*. If the side *AC* is twice as long as *A′ C′,* then every side and every altitude or other line in the larger triangle is twice the corresponding side or line in the smaller one.

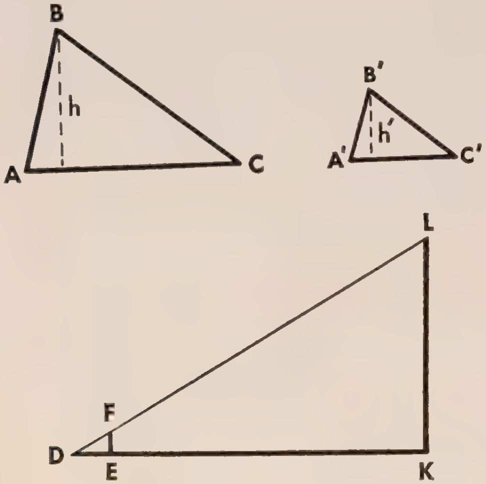


Fig. 6. Similar Triangles

Similar triangles can be used to find unknown distances or lengths, such as the height, *KL,* of a building that casts a shadow of length *KD.* A stick, *EF,* is erected where the end of its shadow also falls on *D,* and the distances *KD* and *ED* are measured. Since triangles *DEF* and *DKL* are similar, the ratio of *KL* to *EF* is the same as the ratio of *KD* to *ED.* If *KD* is 100 times *ED,* then the height *KL* is 100 times *EF,* the length of the stick. All architectural plans and many maps are based on the properties of similar triangles and other similar figures.

Spherical Triangles are the basis of spherical trigonometry. A spherical triangle is a closed figure on the surface of a sphere formed by arcs of three great circles. (Any plane passing through the center of a sphere cuts the surface in a great circle. The earth's equator and meridians of longitude are great circles, but not its latitude circles.) Unlike plane triangles, spherical triangles may have two or three right angles, and even two or three obtuse angles. In the spherical triangle *ABC* in Fig. 7, *A* might be the North Pole of the earth, *EQ* the equator, and *AB* and *AC* two arcs of longitude circles. If *AC* is the meridian of Greenwich and *AB* is 90° west longitude, the spherical triangle has three right angles.

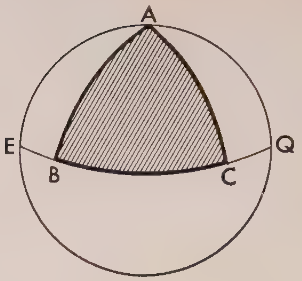


Fig. 7. Spherical Triangle

TRIASSIC, *try as′ik,* **PERIOD,** in geology, the first of the three periods of the Mesozoic Era, which began about two hundred million years ago (see chart under Geology). The Triassic system of rocks, formed from the sedimentary deposits of this period, is found in all continents. The thick beds of New Red Sandstone which occur in Great Britain reappear in Germany in two layers separated by a limestone layer. The term Triassic comes from the German word *Trias* for this threefold deposit.

Marine deposits of this period along North America's Pacific-coast area include limestones and shales as well as coarser rocks, sometimes interbedded with great thicknesses of igneous rocks. East of the Appalachians, predominantly red Triassic rocks of the Newark series often show mud cracks, ripple marks, pits formed by raindrops, and, especially in Connecticut, vast numbers of footprints left by many kinds of dinosaurs. Red (or brown) sandstones from New Jersey and the Connecticut Valley were once popular building stones. Between the sedimentary beds of the Newark series are dark igneous rocks. Intruded dikes and sills are present, and the edge of one sill forms the Palisades of the Hudson River. In parts of the American West, as in the Painted Desert of Arizona and Zion National Park, Triassic rocks are widespread and colorful. In Wyoming and elsewhere great beds of gypsum and red sandstone tell of an arid Triassic climate there.

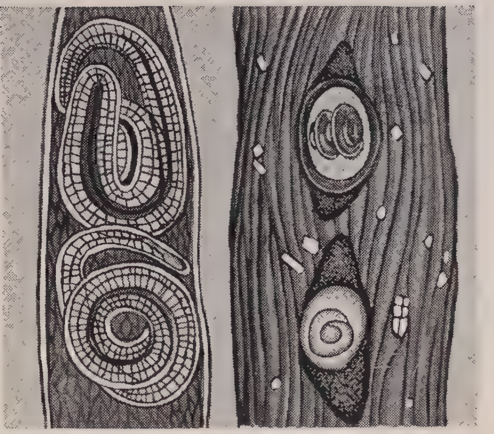
The commonest plants of the period were seaweeds, ferns, cycads, and the conifers that predominate in the Petrified Forest. Reptiles, including small dinosaurs, were very numerous, and the first mammals made their appearance. See also Amphibians; Conifers; Cycad; Dike; Igneous Rocks; Sedimentary Rocks.

TRIB′UNE, the name given to several officials in ancient Rome. Under the republic, *military tribunes* were elected by the people to serve as administrative officers of the legions raised for the Roman army by the *tribes,* or political units of the populace. The more important *tribunes of the people* were the representatives of the plebs (plebeians), the class of Roman citizens who were not patricians. In the early years of the fifth century B.C., the plebs decided to organize in order to protect themselves against arbitrary decisions of the magistrates. They elected tribunes whose duty was to protect the rights of the plebs, and they swore to uphold the men they elected and to protect them, in turn, against any attack. The tribunes could call meetings of the plebs and could defend a member of the group against the decree of a magistrate. Eventually the tribunes were recognized by the Senate and given great power under the republic. The office lost its major functions during the empire and became an honorary title. See also PATRICIAN; PLEBEIAN; ROME, HISTORY OF.

TRICERATOPS, *try sehr'uh tops.* See DINOSAUR.

TRICHINA, *trih ki'nuh,* a tiny worm that infests human beings, pigs, bears, dogs, cats, rats, and foxes, causing the disease trichinosis. This parasite is known scientifically as *Trichinella spiralis.* Human beings acquire trichinosis by eating raw or insufficiently cooked pork that contains encysted (enclosed in capsules) trichina larvae. After the larvae have been eaten, they pass into the victim's intestine, where they develop into mature worms between one-sixteenth and one-eighth inch long. Within a few days the male and female worms mate, and the females give birth to thousands of microscopic larvae, which enter the host's, or victim's, blood vessels and migrate throughout the body. Eventually they settle in the muscles, each larva curling up and forming a resistant wall about itself. In this condition it is known as a *cyst.*

For about the first week after the trichina larvae have been ingested the victim is nauseated and has diarrhea. Then, as the larvae begin to migrate and enter the muscles, the muscles become swollen and painful, various parts of the body (especially the area around the eyes) swell, a slight fever develops, and general fatigue appears. When the larvae encyst in the muscles, the symptoms subside, and eventually the encysted larvae die. The seriousness of trichinosis depends upon the number of worms that have been eaten. If only lightly infested, a person may feel little or no discomfort throughout the entire course of the disease.


TRICHINA LARVAE, greatly enlarged, are shown at left as they move through the body and at right as they appear in cysts in the muscles.

Pigs become infested with encysted trichina larvae when they are fed uncooked garbage containing infected pork scraps or when they eat infected rats. The worms undergo the same development in the pigs as they do in man, eventually becoming encysted in the muscles. The cysts are transferred to human beings or other pigs when the pig's flesh is eaten.

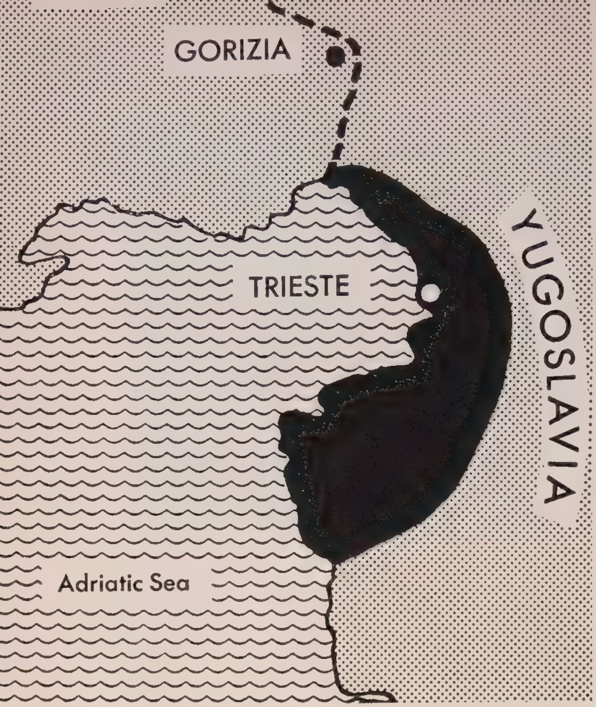
Although there is no specific treatment for trichinosis, there are definite ways of preventing it. The cysts can be killed by cooking pork so that all parts of the meat are heated to 137°F. or more, by freezing the meat at very low temperatures, or by approved methods of salting and drying. Trichinosis can be prevented in large measure by farmers, who should avoid feeding their pigs raw garbage.

TRICHINOSIS, *trik ih no'sis.* See TRICHINA.

TRICYCLE, *tri'sik'l.* See BICYCLE.

TRIESTE, *tree est',* FREE TERRITORY OF, an independent district comprising the city of Trieste and a part of the Istrian Peninsula at the head of the Adriatic Sea. The Territory has an area of 320 square miles. It is bounded by Yugoslavia on the northeast, east, and south, by the Adriatic on the west, and on the extreme northwest by Italy. The total population is about 350,000, and perhaps 80 per cent of the inhabitants, who are concentrated mainly in the city of Trieste, are Italians. Both Italian and Slovene are used as official languages. The currency is Italian. With a good harbor and railroads connecting it with Munich, Vienna, Budapest, and the cities of Italy and the Balkans, Trieste is a strategic shipping center. Shipyards, large oil refineries, silk and paper mills, and foundries make it industrially important.

Trieste was founded in early times and became a Roman colony under the empire. Ruins of Roman structures are still stand-



A TROUBLE SPOT ON THE ADRIATIC, little Trieste has caused not only sharp debate between Italy and Yugoslavia but also serious concern among the diplomats of the world's great powers.

ing. During the Middle Ages the town came under the rule of various conquerors and in 1382 was added to the Hapsburg dominions. Emperor Charles VI declared it a free port in 1719. Trieste was Austrian until the end of World War I, when it was seized by Italy. Yugoslavia also laid claim to the city, and after World War II both nations renewed their demands. Under the terms of the Italian peace treaty, September 15, 1947, the Free Territory was established. But disagreement between the nations led to the division of Trieste into two zones, one administered by the United States and Great Britain, the other by Yugoslavia. In 1954 Italy was given the right to administer most of the northern zone including the city of Trieste; Yugoslavia administers the remaining area.

TRIGONOMETRY, *trig oh nom′eh trih,* a branch of elementary mathematics in which formulas are developed for finding, numerically, the sides and angles of triangles. It is therefore of great practical value in such technical and scientific work as surveying, astronomy, navigation, map making, and many other fields of science and engineering. Its study can be undertaken after the study of algebra and geometry, upon which it depends. When three parts of a plane triangle are known, at least one of which is a side, the numerical values of the other parts can then be calculated by the formulas of *plane* trigonometry. *Spherical* trigonometry is concerned with the solution of spherical triangles on the surface of a sphere.

Calculations in trigonometry make use of certain numbers, or *trigonometric functions* of angles. Suppose a, b, and c are the sides opposite angles A, B, and C, respectively, in a right triangle ABC in which C is the right angle and c the hypotenuse. Then the function called the sine of angle A is defined as the ratio of side a to side c; that is, sine $A = a/c$. Similarly, cosine $A = b/c$, and tangent $A = a/b$. Many tables of numerical values are available for these functions and three other functions of all angles. From such a table one finds, for example, that sine $5^\circ = 0.087$, sine $30^\circ = 0.500$, and sine $80^\circ = 0.985$. If the equation for a length k, in feet, is $k = 10$ sine 80°, then $k = 10 \times 0.985 = 9.85$ feet. See also TRIANGLE.

TRIL′LIUM, or **WAKE-ROBIN**, a genus of highly attractive woodland plants of the lily family. The various species grow from thick rootstocks to heights of from two inches to two feet. Their naked stems are topped by a whorl of three broad, ovate, pointed leaves, above which appears a handsome flower with three petals and three sepals. The white, greenish, purple, or brownish flowers open in spring, some so early that they appear in the snow, whence the name wake-robin. They are succeeded by oval, often red, many-seeded berries. Both the rootstocks and berries are thought to be poisonous.

TRIN′IDAD, BRITISH WEST INDIES, the most southerly island of the West Indies, lies close to the northeastern coast of Venezuela, opposite the delta of the Orinoco. The island has an area of about 1,864 square miles and a population of more than half a million, most of them either West Indian Negroes or East Indians. The Europeans are English, French, Spanish, or Portuguese. With Tobago, a smaller island nearby, Trinidad forms a British crown colony; English is the official language. Under the constitution adopted in 1949, the colony is governed by a legislative and an executive council. The capital is Port of Spain, the chief city of Trinidad.

Lying near the equator, Trinidad has a tropical climate, with a dry season from January to June and a wet season from June to December. It is a popular winter resort. The island is crossed by ranges of low mountains, none more than about three thousand feet high. Abundant rainfall and fertile soils make Trinidad a thriving agricultural land. Sugar, cocoa, grapefruit, rum, and Angostura bitters are valuable exports, but the principal source of income is from petroleum and petroleum products. Pitch Lake, in the southwest, in the region of the oil wells, is a remarkable bed of semiliquid asphalt, from which comes most of the world's supply.

Trinidad and Tobago Tourist Board

THE COCONUT PEDDLER, with his donkey-drawn cart, is a familiar sight on the streets of Port of Spain, Trinidad.

Columbus discovered the island on his third trip to the Western Hemisphere, in 1498. He named it Trinity because one of the sailors saw three hills close together. Trinidad remained Spanish until 1797, when it was occupied by British troops. It was formally ceded to Great Britain in 1802. In 1940 the United States acquired naval and air bases on Trinidad under a ninety-nine-year lease.

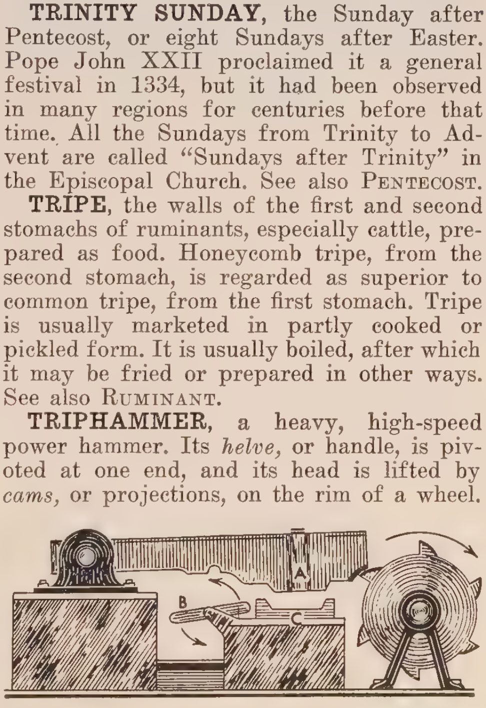
TRINITROTOLUENE, *try nye troh tol′-yu een.* See TNT.

TRINITY, in Christian theology, designates the union of Father, Son, and Holy Ghost as three Persons within the Godhead: "The Father is God, the Son is God, the Holy Spirit is God; yet not three gods, but one God." This is the orthodox Christian teaching, first authoritatively set forth at the Council of Nicaea in 325. The doctrine of the Trinity is implied rather than specifically stated in the New Testament, and its development has involved many theological and philosophical subtleties. Like most Christian doctrines, the Trinity is a paradox, contrary to human understanding. This is inevitable, since the Trinity symbolizes eternal Being — a Being who is perfect Love — whereas our understanding is limited to concepts involving time and space. Although generally looked upon as a belief basic to Christianity, the doctrine of the Trinity is rejected by Christian Scientists, Unitarians, and some other Protestants.

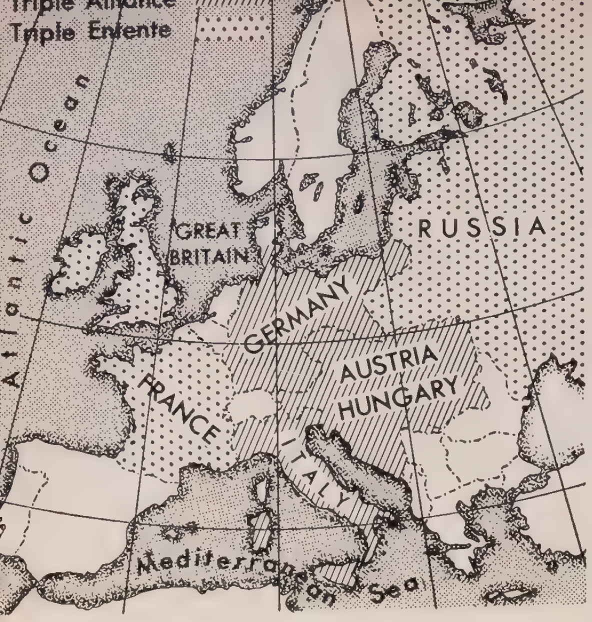
TRINITY SUNDAY, the Sunday after Pentecost, or eight Sundays after Easter. Pope John XXII proclaimed it a general festival in 1334, but it had been observed in many regions for centuries before that time. All the Sundays from Trinity to Advent are called "Sundays after Trinity" in the Episcopal Church. See also PENTECOST.

TRIPE, the walls of the first and second stomachs of ruminants, especially cattle, prepared as food. Honeycomb tripe, from the second stomach, is regarded as superior to common tripe, from the first stomach. Tripe is usually marketed in partly cooked or pickled form. It is usually boiled, after which it may be fried or prepared in other ways. See also RUMINANT.

TRIPHAMMER, a heavy, high-speed power hammer. Its *helve,* or handle, is pivoted at one end, and its head is lifted by *cams,* or projections, on the rim of a wheel.



WHEREVER METALS ARE WORKED, in foundries, machine shops, and ornamental metalworks, the triphammer is useful. This simple hammer (A) may be held up by the prop (*B*) to permit the adjustment of work on the anvil (C).



As each cam passes the point of contact, the hammer falls by its own weight. See also Steam Hammer.

TRIPLE ALLI′ANCE, an agreement under which Germany, Austria-Hungary, and Italy promised to fight together if any one of them was attacked by another power. The Triple Alliance was formed in 1882 and lasted, with several renewals, until 1915. It was preceded in 1879 by the agreement under which Germany and Austria-Hungary agreed to join forces if either side was threatened by Russia. Italy turned this alliance into the Triple Alliance in order to have allies against France, which was Italy's rival for colonial territories in Africa. Germany, rapidly developing into a great world power, thus sought to gain full protection against any Russian move and to cut France off from powerful allies.

But Italy and Austria-Hungary were rivals for power in the region around the Adriatic Sea, and Austria-Hungary held border districts inhabited by Italian-speaking people, which Italy claimed. Italy, therefore, looked for friends outside the Triple Alliance and in 1902 secretly agreed with France that if either were attacked or forced into war, the other would remain neutral. In 1914, when World War I began, Italy refused to enter the conflict with its partners in the Triple Alliance, and the next year it joined France, Russia, Great Britain, and the other Allied powers against Germany and Austria-Hungary.

This Triple Alliance was only one of a number of alliances joining three nations in European history. Such diplomatic combinations often came into being in order to prevent one very powerful nation from gaining too much territory. The partners changed as the balance of power shifted. In World War II the Axis powers, Germany, Italy, and Japan, were joined in a triple alliance. See also Balance of Power; Bismarck-Schönhausen; World War (I, II); and historical sections in articles on the countries mentioned above.

TRIPLE ENTENTE, *ahn tahnt′*, the friendly relationship of Great Britain, France, and Russia in the period leading up to World War I. With strong Germany supported by Austria-Hungary and Italy in the Triple Alliance, the other powers saw the need to settle their disagreements with each other in order to safeguard the interests of all against any German move. In 1893 Russia and France entered into a military alliance in which they promised to join forces if either was attacked by Germany or one of its allies. In 1904, France and Great Britain entered into the Entente Cordiale, or "friendly understanding," which lessened their rivalry over political control of parts of North Africa. The French fleet became the "policeman" of the Mediterranean Sea, while Britain's navy became the guardian of the peace along the Atlantic coast. In 1907, Russia and Great Britain settled their differences over political influence in various parts of Asia. Although the Triple Entente was not an official alliance, the three friendly powers joined forces as allies in World War I. See also Balance of Power; Triple Alliance; World War I.

TRIPOLI, *trip′oh lih*, the capital and principal seaport of the North African state of Libya, is situated on the Mediterranean coast in the territory of Tripolitania. It is the northern terminus of three ancient caravan routes across the Sahara, and it is also served by three short railroad lines. The city is a market and a shipping center for goods brought from the interior and for the grain, olives, dates, and figs grown in the richly fertile nearby oases. The white, flat-roofed houses are built on the slopes rising from a crescent-shaped bay. Along the fine new boulevard that follows the shoreline are modern hotels and buildings in the European style. The crowded native quarter is a section of narrow, winding streets overhung by arches or roofs.

Once called *Oea*, Tripoli got its present name because in ancient times it was one of three Roman cities close together on the coast. For a long time Tripoli was a stronghold of the notorious Barbary pirates, who exacted tribute from shipping in the Mediterranean. Nominally the region was under Turkish rule, and in 1911, Italy seized the province from the Turks. Italian colonists were encouraged to settle in Libya, and eventually Mussolini attempted to recreate a Roman empire in Africa. Tripoli was taken by the British during World War II, and after the end of the war it became the capital of the independent state of Libya. The population is about 140,000. See also Barbary States; World War II.

TRI′REME. See Galley.

TRIT′IUM, a radioactive variety (isotope) of hydrogen with an atomic nucleus three times as heavy as one of ordinary hydrogen (see Atom; Isotopes). It was found first in artificial transmutation experiments and later in minute amounts in surface waters (see Transmutation of Elements). It is by far the rarest of all atoms that occur in nature, there being about one atom of tritium for every million million million atoms of ordinary hydrogen. The isotope is now produced in nuclear reactors, and in the United States it is distributed by the Isotopes Division of the Atomic Energy Commission to scientists for use in artificial transmutations and as a tracer in biological and other experiments.

A tritium nucleus, the *triton,* carries a unit of positive charge, being made up of a proton and two neutrons. It decays by emitting a beta particle, and its half life, the time in which half of any given quantity of it decays, is about twelve years (see Beta Particle). Nuclear energy may be obtained by the *fusion,* or joining, of the nuclei of tritium and deuterium, another hydrogen isotope. Deuterium has one proton and one neutron in its nucleus (see Deuterium). The first hydrogen-bomb blasts resulted from the fusion of these two isotopes. The high temperature required was supplied by an atomic bomb explosion resulting from nuclear *fission.* See also Atomic Bomb; Atomic Energy.

TRIUMVIRATE, *try um′vih rate,* in Roman history, a political coalition of three men. The First Triumvirate, which was formed in 60 B.C., was an alliance between Pompey, Crassus, and Julius Caesar. These three men worked together to keep the supreme authority in their own hands. In 43 B.C the Roman Senate gave full power for a term of five years to a triumvirate consisting of Antony, Lepidus, and Octavian, who later became the Emperor Augustus. This grant of power was renewed in 37 B.C., but Lepidus was forced to withdraw the following year. See also Rome, History of.

TRO′GON, a family of colorful birds found in tropical America, Africa, and Asia. The sixty species vary in color, but many have iridescent black or green heads, throats, and breasts in sharp contrast with bright-crimson or yellow under parts. The long, brightly colored tail is often edged with black and white. Trogons eat fruit, berries, and insects. They nest in hollow trees or stumps. The most spectacular bird of the trogon family is the quetzal, once the sacred bird of the Mayas and the Aztecs. See also Quetzal.

TRO′JAN WAR, a legendary struggle between the Achaean Greeks and the inhabitants of Troy, a great city of Asia Minor. It is perhaps the most famous of all wars because the Greek poet Homer, about 900 B.C., used the legends about it as material for the *Iliad* and the *Odyssey,* two masterpieces of epic poetry. Homer did not create the legends he used; they had probably been told by one generation to the next for a very long time. But there was probably a basis of truth in the old stories.

Troy, a rich and prosperous town, lay close to the Hellespont, the entrance to the water route between the Aegean and the Black Sea. The Achaeans, who had invaded the mainland of Greece and had absorbed the Mycenaean empire and culture, were warriors and traders; they may have undertaken the raid on Troy partly to gain control of the Hellespont and partly to seize the rich treasures of the city. The Greeks took the city after a long siege and burned it. Tradition sets the date at about 1200 B.C. In the centuries that followed, a web of myth and legend was woven around the real happenings at Troy.

The story of the war as it has come down to modern readers is set forth mainly in Homer's poems, but the *Iliad* covers only a brief part of the ten-year siege, and in the *Odyssey,* Odysseus (Ulysses) tells about only a few of the happenings at Troy. The details of the beginnings of the war and the final sack of the city are found in Vergil's *Aeneid* and in the works of the Greek tragic poets, particularly Aeschylus, Sophocles, and Euripides.

Origins of the War. According to legend, the original cause of the conflict was a jealous rivalry among three Olympian goddesses. Eris, the unpopular goddess of discord, annoyed because she had not been invited to the wedding banquet of the nymph Thetis, tossed among the guests a golden apple marked "For the Fairest." It was claimed by Aphrodite, Pallas Athena, and Hera. Zeus, the king of the gods, wisely refused to award the trophy and selected Paris, son of the Trojan king Priam, to render judgment. Each of the three goddesses tempted Paris with bribes. Hera promised him a throne over Europe and Asia, and Athena offered him a great victory for Troy over the Greeks. But he gave the apple to Aphrodite, who promised him the most beautiful woman in the world for his wife.

The Abduction of Helen. Aphrodite led Paris to the court of the Spartan king Menelaus, whose wife Helen was the most beautiful woman of her time. Paris made love to Helen and carried her off, not entirely, say the poets, without her consent. The Greek chieftains, bound by oath to avenge any injury done the Spartan royal family, joined Menelaus in an expedition to recover Helen. Their commander in chief was Agamemnon, king of Mycenae and a brother of Menelaus. Achilles, Patroclus, Odysseus, Diomedes, Nestor, and the two Ajaxes were leaders of the Greeks.

For many days the goddess Artemis, angered by a sacrilege the Greeks had committed, held them in the port of Aulis. To appease her, Agamemnon's daughter Iphigenia was offered as a sacrifice. Then favorable winds blew, and the Greeks set sail with 100,000 men aboard 1,186 ships.

The War Begins. Protesilaus, the first Greek to go ashore, was struck down by a Trojan spear; and so the fighting began. King Priam's valiant son Hector led the Trojan forces. Aeneas, Pandarus, and Glaucus were among his supporters.

For nine years the fighting continued, with victory going first to one side, then to the other. The strife reached even Olympus, where the gods and goddesses bickered over the fate of their favorites. When the *Iliad* takes up the story, the struggle was entering its tenth year. The poem describes a bitter quarrel between Agamemnon and Achilles, the death of Achilles' friend Patroclus, and the fight between Achilles and Hector, in which Hector was slain by the Greek hero. With the great mourning for the Trojan prince, the *Iliad* closes.

The Wooden Horse. Not long after the death of Hector, Achilles was killed by an arrow shot by Paris, and Paris himself fell at the hands of the Greeks; but still the fighting went on. The Greeks learned that Troy could not be taken while the Palladium, a sacred image of Athena, remained within the walls. One dark night Odysseus and Diomedes scaled the walls and carried off the image. The Greeks were greatly heartened by this omen, but since it was clear that the city could not be entered by force, they resorted to trickery. At the suggestion of Odysseus they built a hollow wooden horse, large enough to contain a group of warriors. Then, leaving the horse on the shore, the Greeks put to sea as though they had given up the siege. One man, Sinon, was left to lead the Trojans into the plot.

Cautiously the astonished Trojans approached the wooden horse. Sinon let himself

OUT OF THEIR HIDING PLACE, IN THE DEAD OF NIGHT, creep the Greek soldiers, ready to attack the sleeping city of Troy. This picture, "The Trojan Horse," was painted by Henri Motte.

Corcoran Gallery of Art

be discovered and reluctantly explained that the horse had been built as an offering to Athena. Its enormous size, he said, was to prevent its being taken through the city gates, for a prophet had warned that victory would go to the possessors of the wooden horse. Convinced, the Trojans decided to take the horse into the city. Only the priest Laocoön advised against it, saying, "I fear the Greeks even when they bear gifts." Suddenly two serpents glided out of the sea and twisted their coils about Laocoön and his two sons. The Trojans, thinking that the gods had visited punishment upon Laocoön, dragged the wooden horse into the city.

The Fall of Troy. That night, while the people of Troy slept, the Greek warriors emerged from their hiding place in the horse and opened the gates of the city to the rest of the Greeks, who had returned under cover of darkness. The citadel was taken by fire and sword. Men, women, and children were slaughtered, and those who escaped death fled the burning city. Troy was sacked by the Greeks, and the Trojan War came to an end.

Related Articles. For additional information, consult the following titles:

Aegean Civilization	Iphigenia
Aeneid	Mythology
Agamemnon	Nestor
Ajax	Odyssey
Hector	Paris
Helen	Troy
Homer	Ulysses
Iliad	Vergil

TROLLOPE, *trol'up,* ANTHONY (1815-1882), English author of more than fifty novels, books of travel, and a delightful *Autobiography,* was born in London. He entered the postal service and rose to a position of importance, but in 1844 he began to write. His first books had little success, but with his quiet, realistic studies of the clergy and other citizens of an English cathedral town he achieved wide popularity and became a wealthy man. Trollope always remained as simple, kindly, and honest as the books he wrote. Modern readers still take pleasure in the gentle humor and witty characterizations in *The Warden, Barchester Towers,* and the other chronicles of Trollope's "Barsetshire."

TROM'BONE, a brass wind instrument with a tube that is mostly cylindrical and a cup-shaped mouthpiece. The modern trombone differs very little from the earliest form of the instrument, which was developed in the fifteenth century by adding a slide to a large trumpet. This slide, the distinguishing characteristic of the trombone, corresponds to the valves in the other brass instruments. It can be pushed out or pulled in, thus increasing or decreasing the length of the tube and enabling the player to produce all the notes in a chromatic scale. The trombones most commonly used are the tenor, the tenor-bass, and the double-bass.

TROPICAL CYCLONE. See HURRICANE.

TROPICAL DISEASES. See CHOLERA; DENGUE; DYSENTERY; FILARIA; HOOKWORM; LEISHMANIASIS; LEPROSY; MALARIA; PLAGUE; SCHISTOSOMIASIS; TRYPANOSOME; TYPHUS; YELLOW FEVER.

TROPICAL FISH, certain small freshwater fish often kept in home and school aquariums. Over three hundred species are known, most of them originating in Africa and South America. The smallest are less than an inch long, the largest about eight inches. Most are brightly colored and gracefully formed. Some, such as the *cichlids,* are so savage that they must be separated from other species. Among the better-known tropical fish are the *guppies, goldfish, tetras, barbs, danios, rasboras,* and the *scalare,* or *angelfish.*

Tropical fish have interesting reproductive habits. The males and females of some cichlid species, popularly known as kissing fish, join lips and appear to be either kissing or carrying on a tug of war. The female Japanese *medaka* carries clusters of eggs outside its body, the *gularis* buries its eggs in the sand, and the female *Egyptian mouthbreeder* holds the eggs in its mouth until they hatch. *Gouramis* and *fighting fish,* or *bettas,* place their eggs in bubble nests at the surface of the water, the male guarding them closely. *Mexican swordtails* and *platys,* which frequently interbreed, give birth to living young, as do the *mollies* and others. Guppies, the most popular of all aquarium fishes, also bear living young. Like many other tropical fishes, they will eat their own offspring and should be removed from the aquarium after breeding.

Raising Tropical Fish. Depending upon the species of fish, the temperature of the water in the aquarium should be kept between 70° and 85°F. Aquatic plants may be added to a small aquarium to help provide sufficient oxygen for the fish, but in larger aquariums compressed-air circulation or devices for circulating the water may be required to provide aeration. Tropical fish are usually fed commercially prepared foods, and now and then bits of raw meat, shellfish, and fish. They should be given food once each day and only as much as they can eat in five minutes, since excess food will decay and cause contamination of the aquarium. A glass cover placed over the aquarium will keep the fish from leaping out and also aids in maintaining an even temperature. See also ANGELFISH; AQUARIUM; ARCHERFISH; GOLDFISH.

TROPIC OF CANCER. See TROPICS.

TROPIC OF CAP'RICORN. See TROPICS.

DENSE, HUMID JUNGLES AND OVERGROWN SWAMPLANDS like those along the Amazon River (3) are often found in tropical regions, but also in the tropics are snow-capped peaks like Africa's Mount Kilimanjaro (1) and bleak wastelands like those of Africa's Great Rift Valley (2).

TROP'ICS. The tropics are the central regions of the globe. They lie along the equator and extend for 23½° to the north and to the south. Their limits are two parallels of latitude, the Tropic of Cancer to the north and the Tropic of Capricorn to the south; between these parallels the sun is overhead at noon at least once each year and its rays fall vertically on the earth. An observer north or south of the parallels never sees the sun directly overhead. This tropical belt, sometimes called the torrid zone, exists because the earth's axis is not perpendicular to the plane of its orbit but tipped at an angle of 23½° from the vertical. See EQUINOX; SEASONS.

Climate. The zone between the Tropic of Cancer and the Tropic of Capricorn includes a large part of Central and South America, the West Indies, central Africa, the peninsula of India, Malaya, the East Indies, and northern Australia. There are great variations of climate within the tropics, and tropical climates are sometimes found outside these limits. Altitude, distance from the sea, the position of mountain ranges, and the direction of the prevailing winds all play a part in determining the climate of any region. In mountain country the climate changes as the altitude increases, and even in equatorial regions temperate and arctic types of climate are found on the middle and upper slopes of high ranges.

The sun's position in the sky and the number of hours of sunlight in each day are also important factors affecting climate. Rays that fall vertically are concentrated in a smaller space than those that strike the earth at an angle, and they are more effective in delivering heat. For this reason the average temperature is high all through the year in the tropical lowlands. The sun, however, is above the horizon for little more than twelve hours each day, and the thermometer seldom registers anything like the maximum temperatures of the temperate zones in summer, when the sun shines for a much greater portion of the day. Even in the Arctic, summer temperatures may exceed 100°F., while in the tropics the normal daily range is between 75° and 85°.

Seasons. In the tropics there are only two seasons, the wet and the dry. Close to the equator there is little difference between the two, but as the distance from the equator increases, the contrast between the wet season and the dry is more and more pronounced. The wet period comes when the sun is nearly overhead at noon, the dry, when it is lowest in the sky.

Tropical Lands. In the tropics are three typical kinds of country: the *rain forest,* the *savanna,* and the *desert.* In the neighborhood of the equator, day and night are always equal in length, the atmosphere is generally calm, and warm air, rising from the land, carries moisture that condenses and falls as rain. In the lowlands, rainfall may average from 60 to 100 inches a year, or even more. The daily range of temperature is small, and the humidity is moderately high. Under these conditions the tropical rain forests cover the land. Trees grow very tall and close together. Since there is no dry season they do not lose their leaves. Their lower branches cut off sunlight from the ground below, and little vegetation springs up on the forest floor. Grass-eating animals are scarce, for they can find little food, but tree-dwelling creatures like birds and monkeys are common, and along the rivers and in the swamps are some animals that like the water.

Where the land is cleared so that sunlight can reach the ground, wild vegetation grows so rapidly that it soon chokes the crops. Insect pests make life difficult for man, and the continuous heat, with only the daily rain to break the monotony, is hard to bear. The rain forest is sparsely inhabited. Soils are generally poor and lacking in minerals, methods of agriculture are simple and wasteful, and the climate robs men of energy. The native peoples of the rain forests in America and Africa have seldom achieved anything more than a primitive kind of existence based on food gathering, fishing, and hunting. They need only very little clothing, a simple kind of shelter from the rain and sun, and their food is easily found. There is no reason to do much work. In the Western Hemisphere, the Mayas of Central America were perhaps the only people of the rain forest to reach a high level of culture (see MAYA). In the Orient the growing of rice in tropical rain forests has supported a large population.

Along the northern and southern edges of the rain forests there is a noticeable dry season, which limits the growth of trees. The trees shed their leaves, and grass, with other low vegetation, has a chance to grow vigorously. Here are the dense tropical jungles, where the trees are farther apart and a luxuriant tangle of undergrowth covers the ground. The jungle is more productive than the true rain forest, and it has more inhabitants. Some of these regions have been opened up and developed by men from the more advanced countries of the world. Rubber, oil, and tropical woods are important products.

The jungle merges slowly with the savanna, or grassy plain. The wet savannas, close to the edge of the rain forests, are usually marked by some tall trees and high grass. In those on the edge of the desert, where rainfall is light, the trees are low and scattered. Wildlife is abundant; the vegetation furnishes food for many kinds of animals, and they, in turn, are preyed on by the meat eaters. The tropics show a remarkable variety of plants and animals. There is an enormous number of species, though no one species contains a great number of individuals.

The people of the savannas are livestock raisers, farmers, and hunters. The wet savannas produce good crops of many kinds, and the drier regions contain excellent grazing lands. The climate has more variety and hence is more stimulating. The native peoples of the savannas are more successful in making use of their resources than are most of the forest dwellers. A large part of India and Pakistan is savanna; a great civilization developed in this region in prehistoric times.

The deserts that lie along the outer edges of the tropical zone are created by the prevailing trade winds, which blow toward the equator. They grow warmer and drier as they move south, and they absorb moisture from the ground (see DESERT). The Sahara and the Arabian Desert form the largest expanse of tropical desert in the world. Except for the oases they are very thinly populated, but where water is available for irrigation, as in the valley of the Nile, the desert can support a very dense population.

The tropics contain a wealth of natural resources that has hardly been touched. With improved communications and transportation, new medicines with which to fight tropical diseases, modern techniques in agriculture, and a growing demand for tropical products, development of these regions may be rapid.

TROPOSPHERE, *trop′oh sfeer,* the lowest portion of the atmosphere of the earth, in which most weather phenomena occur, such as winds, clouds, and storms. In general the temperature decreases with increasing height in the troposphere. The *tropopause,* which is the boundary between the troposphere and the layer above it, the *stratosphere,* is at a height of about ten miles above sea level over the equator, about seven miles over mid-latitudes, and three or four miles over the poles. These levels vary slightly with the seasons, being somewhat higher in summer than in winter. See also AIR; ATMOSPHERE; METEOROLOGY.

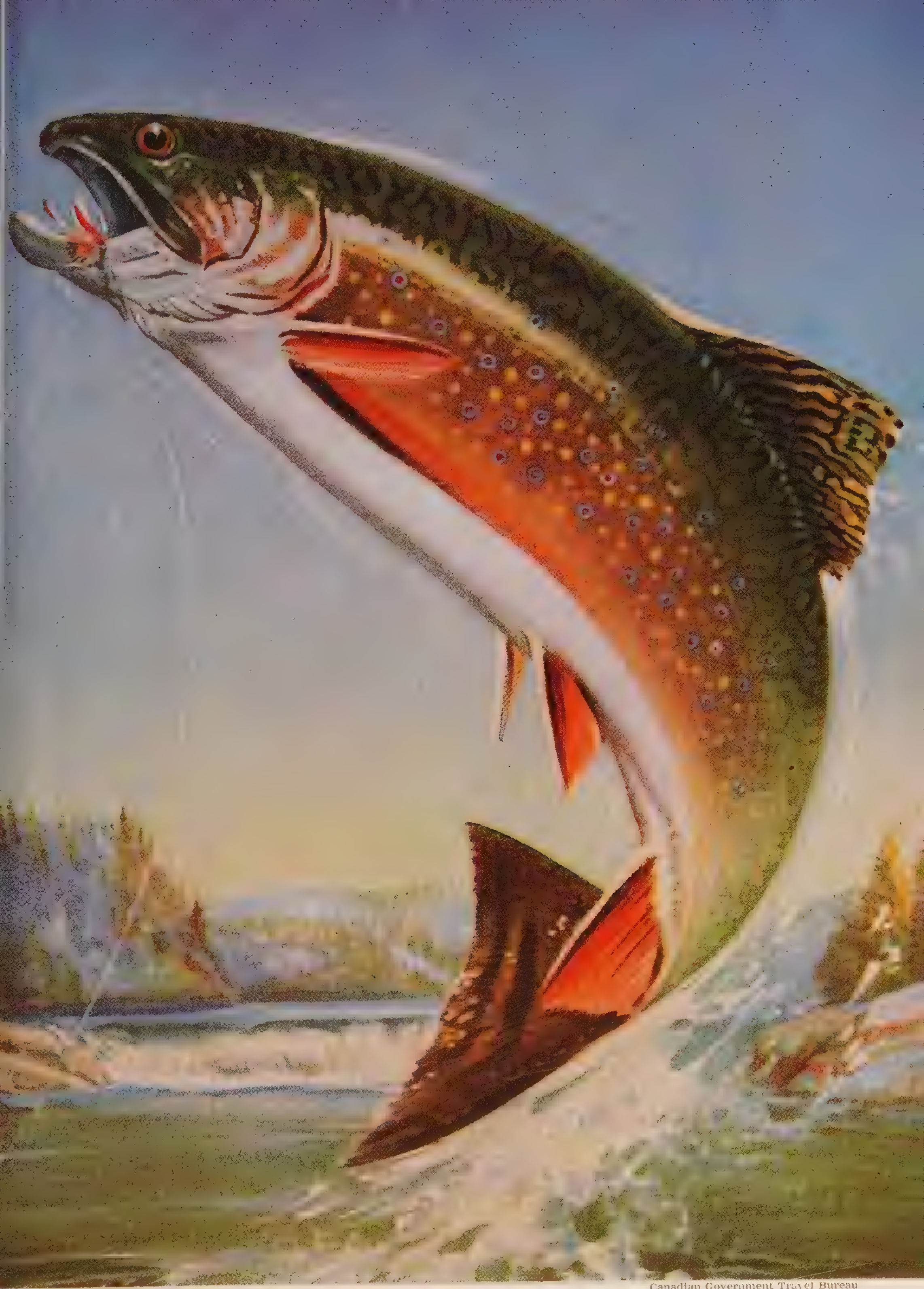
TROTSKY, *trot′skih,* LEON (1879-1940), a Russian revolutionary leader, whose name was originally Lev Davidovich Bronstein, was born in the Ukraine and attended the University of Odessa. He became a member of the revolutionary movement in his youth and was first sent to jail in 1898. In 1900 he was exiled to Siberia but escaped and made his way to London, where he worked with Nikolai Lenin. Lenin, already a vital figure in the radical group of Russian social democrats, was organizing the Bolshevik party, which eventually seized control of Russia. Trotsky did not fully accept Lenin's principles and did not join the Bolsheviks until later, but he worked closely with Lenin.

Trotsky returned to Russia in 1905, was again arrested and sent to Siberia, and again escaped. He worked in Vienna and other cities in Europe for some years, editing socialist papers. During the First World War, which he called an imperialist war, he urged the workers in every country to refuse to fight. In 1917 he spent a short time in New York, but when the Czarist government was overthrown he returned to Russia and joined Lenin as a member of the inner circle of the Bolshevik party.

When, in the fall of 1917, the Bolsheviks seized power from the provisional government headed by Kerensky, Trotsky was made People's Commissar for Foreign Affairs. He led the delegation which signed the Treaty of Brest-Litovsk with Germany in 1918 (see World War I). Later, as Commissar for War, he organized the Red army that managed both to withstand foreign attacks and to win the civil war in Russia.

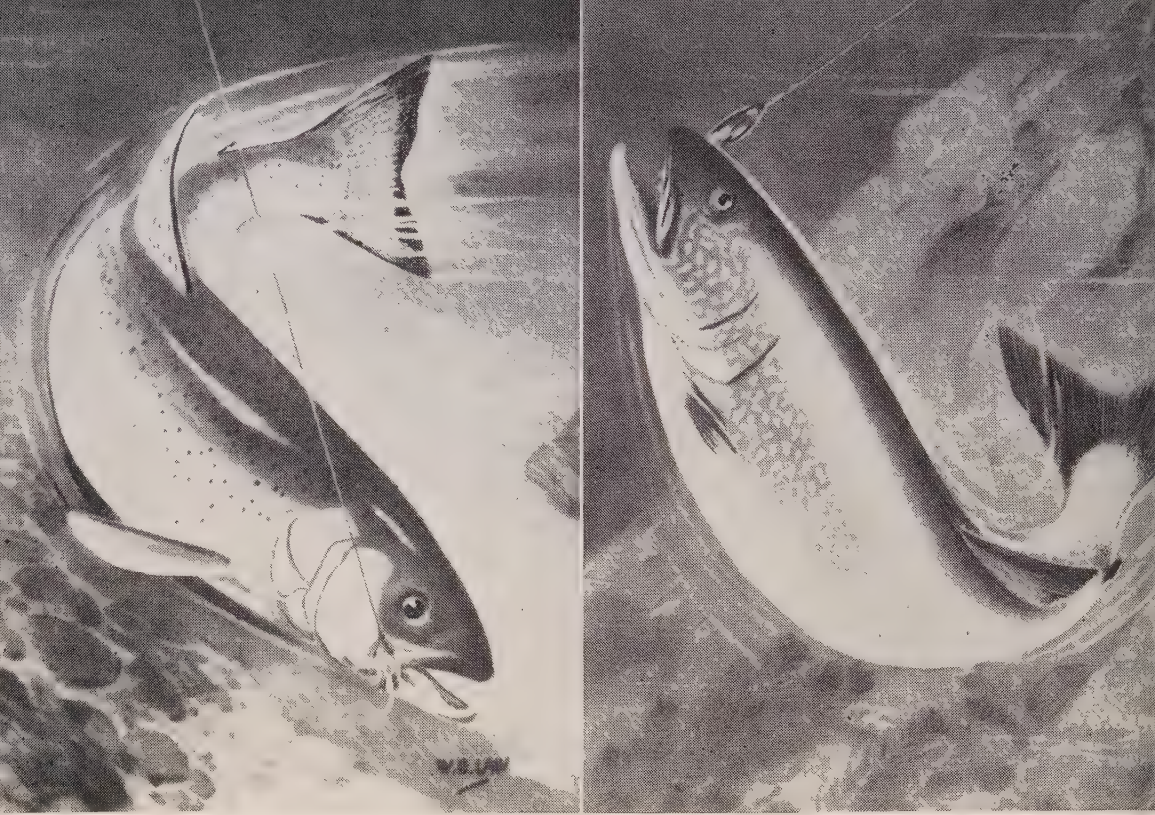
Even before Lenin's death, fundamental disagreements between Trotsky and Stalin, the two principal contenders for the leadership of the party, were apparent. Trotsky's influence declined as Stalin's increased, and he was eventually expelled from the Communist party and from the country. Trotsky lived in Turkey, France, and Norway before settling in Mexico City in 1937. He wrote an autobiography, *My Life,* and the *History of the Russian Revolution,* as well as other books and many articles attacking the Stalinist regime. In August, 1940, he was attacked and fatally wounded by a man he had known for some months. It was rumored but not proved that the murder was instigated by Trotsky's political enemies. See also LENIN, NIKOLAI; STALIN, JOSEPH.

TROUBADOUR, *troo′buh dur,* one of the lyric poets of medieval France who wrote in Provençal, the southern form of the early French language. The troubadours, who were usually knights of noble birth, composed graceful and charming love lyrics and set them to music. They sang their poems and played an accompaniment on the cither. The great period of the troubadours was in the twelfth and thirteenth centuries, and the most famous of these poets lived in the south and the southwest of France. In time their poetry became so burdened with rules and conventions that it lost its freshness



Canadian Government Travel Bureau

EXCITING TO CATCH, DELICIOUS TO EAT, the brook trout sometimes grows to double and triple the average weight of three pounds. Especially large brook trout are found in the cold, clean waters of rivers and lakes in northeastern Canada.



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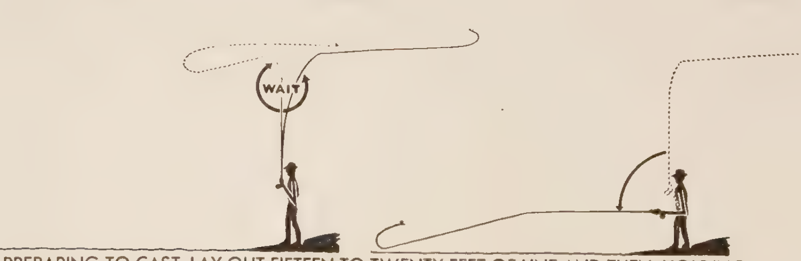
THE FIGHTING KAMLOOPS TROUT (left) attracts many anglers to British Columbia, where these big fish are specially abundant. But record Kamloops, weighing around forty pounds, are only half as heavy as giant lake trout (right).

FLY CASTING FOR TROUT



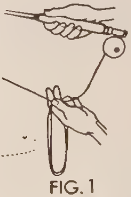


FIG. 1

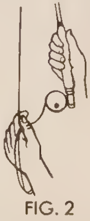


FIG. 2

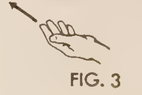


FIG. 3

IN PREPARING TO CAST, LAY OUT FIFTEEN TO TWENTY FEET OF LINE AND THEN, HOLDING THE LINE WITH THE ROD HAND, RAISE THE ROD SO AS TO TAKE THE SLACK OUT OF THE LINE (TOP LEFT). SNAP THE ROD *UPRIGHT,* NOT BACK, KEEPING THE WRIST STRAIGHT AND THE ELBOW AGAINST THE SIDE. CAST THE LINE *UP;* IT WILL TRAVEL BACK (TOP RIGHT). PAUSE UNTIL THE LINE STRAIGHTENS OUT (BOTTOM LEFT). SNAP THE ROD *FORWARD,* NOT DOWNWARD, SO AS TO CAST THE LINE *AHEAD,* NOT DOWN. FOLLOW THROUGH TO THE HORIZONTAL POSITION (BOTTOM RIGHT). AIM THE FLY A COUPLE OF FEET ABOVE THE WATER. TO EXTEND YOUR CAST, HOLD SEVERAL FEET OF LINE IN COILS IN THE LEFT HAND (FIGS. 1, 2 AT RIGHT). CAST AS SHOWN ABOVE. WHEN THE LINE REACHES THE END OF THE FORWARD CAST, RELEASE THE COILS, ALLOWING THE LINE TO SHOOT FORWARD (FIG. 3).

and originality, and the religious wars that devastated southern France broke up the feudal society in which the troubadours flourished. See also TROUVÈRE.

TROUT, game and food fish closely related to the salmon, have a long, fine-scaled body, a scaleless head, and two soft-rayed dorsal, or back, fins, one much reduced. They live in cold lakes and streams, feeding on insects, crustaceans, worms, minnows, and other small fish. Members of a few species live in both ocean and fresh water. The fighting trout is a favorite game fish, particularly in the United States, where government hatcheries keep streams abundantly supplied.

Trout spawn either in early spring or in late fall. The sea-run species migrate into coastal streams to breed, while the others enter smaller inland waters. After scooping out a shallow nest, or *redd,* in the gravel bottom of a stream, the female deposits from a hundred to several thousand eggs about one-third inch in diameter. These are immediately fertilized by the male trout and covered over with gravel. The eggs hatch with the approach of warm weather. After using up the yolk sac attached to the undersurface of their bodies, the young leave the nest. The young ocean-dwelling trout then migrate to the sea, returning to spawn two or three years later.

Kinds of Trout. Trout may be separated into *true,* or *black-spotted,* trout and *chars.* One of the handsomest and gamiest of the true trout is the *rainbow,* which is blue above and silver below, with black dots on its back, a red band along each side, and red head markings. It usually weighs only a few pounds, but specimens up to forty pounds have been taken. Native to rushing streams of the American West, it has been widely introduced throughout North America, Europe, and New Zealand. A close relative is the *steelhead,* a Pacific Ocean form which spawns in fresh water in the spring. Resembling the rainbow, though less brightly colored, it averages about ten pounds. Steelheads are taken commercially from Alaska to California and are also important game fish. As with all other trout, the many subspecies of rainbows and steelheads vary greatly in size and appearance in different localities.

The *cutthroat* species, so called because of the red markings on the underside of the lower jaw, includes both fresh-water and sea-run forms, ranging in size from four to forty pounds, depending upon their distribution. They are found from California north to Alaska and east to the Rocky Mountains.

Brown trout, the common trout of western Europe, were introduced into the eastern United States in 1883, and the *Loch Leven* trout, a Scottish form of the brown trout, followed soon afterward. Interbreeding has made them practically identical in America. Those from American waters weigh up to fifteen pounds; European specimens run considerably larger. The brown trout is brownish with black spots and has a few red dots on the upper parts; the Loch Leven trout lacks the red dots.

Chars differ from true trout in the structure of a certain mouth bone and also in having very small scales which in some species are so deeply imbedded in the skin that the fish appear scaleless. The *lake* trout, a char of North America's deeper lakes, may weigh as much as eighty pounds, though weights of five to ten pounds are more common. These fish are grayish, sometimes with a greenish overcast, and are marked with pale-yellow spots. In winter they move in toward rocky shores to spawn. Those in the Great Lakes are taken by both commercial and sport fishermen. The more than ten million pounds caught annually with gill nets are marketed as whole fish, smoked fish, and fillets. The fish are preyed upon by eels which have invaded the Great Lakes from salt water.

The *brook* trout of the eastern United States and Canada, which has been distributed throughout the West, is also a char. Averaging less than three pounds, its gray or olive-colored body is marked with black or olive mottlings above and red spots on the sides. The fins are a combination of pale yellow, light red, and black. Other chars include the *arctic,* or *northern,* char of the Arctic Ocean and far northern lakes and the *Dolly Varden* trout, a marine and fresh-water species of western North America. Dolly Vardens are olive with large, red spots; the sea-run forms are mostly silvery. They may weigh as much as twenty pounds but are usually much smaller.

Trout Fishing. The usual method of catching trout is by fly-fishing, either with "wet" or "dry" artificial flies. Sometimes such natural bait as live grasshoppers, minnows, insects, worms, or salmon eggs is used. In flowing waters the fisherman ordinarily casts upstream and lets his fly be carried downstream with the current. Most Americans use a wet fly, which sinks beneath the surface, whereas a dry fly floats. Trolling, bait casting, spinning, and still-fishing are other means of taking trout. Methods vary with the locality, the species of fish, and changing environmental conditions. In the United States and Canada the trout fishing seasons are limited by law. See also FISH; GRAYLING; SALMON.

Scientific Names. Rainbow, *Salmo irideus;* steelhead, *S. gairdnerii;* cutthroat, *S. clarkii;* brown trout, *S. trutta;* lake trout, *Cristivomer namaycush;* brook trout, *Salvelinus fontinalis;* arctic char, *Salvelinus alpinus;* Dolly Varden, *Salvelinus malma.*

TROUVERE, *troo vair′*, in medieval times one of the poets who used the northern form of the early French language. The bards who wrote in the southern dialect were called troubadours. The trouvères were often men of noble rank, and their earliest works, the *chansons de geste,* were epic ballads based on earlier French history. Wandering minstrels or jugglers chanted or sang these poems to a musical accompaniment on some kind of lyre or harp. See also TROUBADOUR.

TROY, or **IL′IUM**, a prehistoric city made famous by Homer's epic poems, the *Iliad* and the *Odyssey,* was situated in a region of fertile plains and wooded mountains in the northwest corner of Asia Minor, just south of the Hellespont. Archaeologists believe that a mound called Hissarlik, about three miles from the sea, was the site of ancient Troy. A Greek town occupied the site until the fifth century A.D., and the early peoples of the Aegean accepted the claim of its inhabitants that their city was the modern counterpart of mythological Troy. Excavations begun by Heinrich Schliemann about 1870 revealed the stratified ruins of at least nine cities in the mound. The seventh from the bottom was probably Homer's Troy. From the pottery and beautiful objects in gold, silver, and bronze that it contained, archaeologists concluded that this Troy flourished in the thirteenth or the twelfth century B.C., when the Greek city of Mycenae dominated the Aegean. See also HOMER; ILIAD; ODYSSEY; SCHLIEMANN, HEINRICH; TROJAN WAR.

TROY, N. Y., known as the "shirt city," is situated along the east bank of the Hudson River six miles above Albany and at the head of steamboat navigation. Opposite the city is the mouth of the Mohawk River. Its location gives Troy direct access to the New York State Barge Canal, which connects with Lake Erie to the west. Ships also reach the St. Lawrence River and Canada by way of Lake Champlain. The city is served by three important railroads.

Troy's development as an industrial city began early in the nineteenth century. Iron smelting flourished for more than forty years. From about 1850 the manufacture of men's shirts and collars has been a major business, and today Troy produces the bulk of the country's entire output. It is a leader also in the manufacture of abrasives. Many factories turn out engineering instruments, valves, hydrants, bells, brushes, and clothing. Educational institutions include the distinguished Rensselaer Polytechnic Institute, Russell Sage College for women, and the Emma Willard School for girls. Rensselaer and Willard were pioneer schools in their fields. There are two conservatories of music. The city maintains three hundred acres of parkland.

Dutch sailors from Henry Hudson's famous ship, "Half Moon," first visited the vicinity of Troy in 1609. The land was purchased from the Indians in 1659 and for more than a century served as farmland for Dutch settlers. In 1789, three years after it was finally surveyed as a townsite, it received its present name. The War of 1812 led to construction of the Watervliet Arsenal across the Hudson, and during the War between the States, Troy produced arms and ammunition and part of the machinery for the "Monitor." It became a city in 1816 and is the seat of Rensselaer County. Troy's population is about 71,000.

TROY WEIGHT, a system of weight units for weighing precious metals and stones. These units are the pennyweight, equal to 24 grains; the troy ounce, equal to 20 pennyweights; and the troy pound, equal to 12 troy ounces. The troy pound, no longer legal in Great Britain and little used elsewhere, contains 5,760 grains and is therefore smaller than the ordinary avoirdupois pound of 7,000 grains. The troy ounce of 480 grains is larger, however, than the avoirdupois ounce of 437.5 grains; the ratio of these two kinds of ounces is 192 to 175. Weights less than a troy ounce are still given by jewelers in pennyweights, but the United States Mint gives them in decimal fractions of a troy ounce. Production and imports of gold, silver, and the platinum metals are reported in troy ounces, not in troy pounds. See also MEASURES.

TRUCK. See AUTOMOBILE.

TRUCK FARMING. See AGRICULTURE.

TRUFFLE, a species of mushrooms whose tuberlike bodies are prized for their delicious flavor. They grow underground in woods, mainly in central and southern Europe. The blackish common truffle grows about as large as a potato. The strong odor of most species makes it possible for trained hogs and dogs to locate the truffles by scent. *Pâté de foie gras* is flavored with truffles.

TRUMAN, HARRY S. (1884-   ), thirty-third President of the United States, was the seventh man to succeed to the Presidency through the death of the Chief Executive and the third in this group later to win election to the Presidency in his own right. He held office during a period in which the conflict between communism and democracy caused extreme international tension. At home the President took a vigorous part in the political strife which marked his administrations and labored with mixed results to meet the many great problems facing the nation and the free world.

Early Years. Truman was born on a farm near Lamar, Mo., on May 8, 1884. He was the first-born of John Anderson Truman, a livestock dealer, farmer, and speculator, and Martha Ellen Young Truman. His forebears were the descendants of Scotch and English settlers in Kentucky. Harry grew up in Independence, Mo., and graduated from the local high school in 1901. When poor eyesight prevented him from continuing his education at West Point, he worked at various jobs in Kansas City and then, in 1906, returned to the family farm. Farming and a number of investment ventures in mines and oil wells occupied his time during the next ten years. In 1917 he was called up with the National Guard. In France in World War I he served as captain of an artillery battery, achieved an excellent record, and took great satisfaction in his military career.

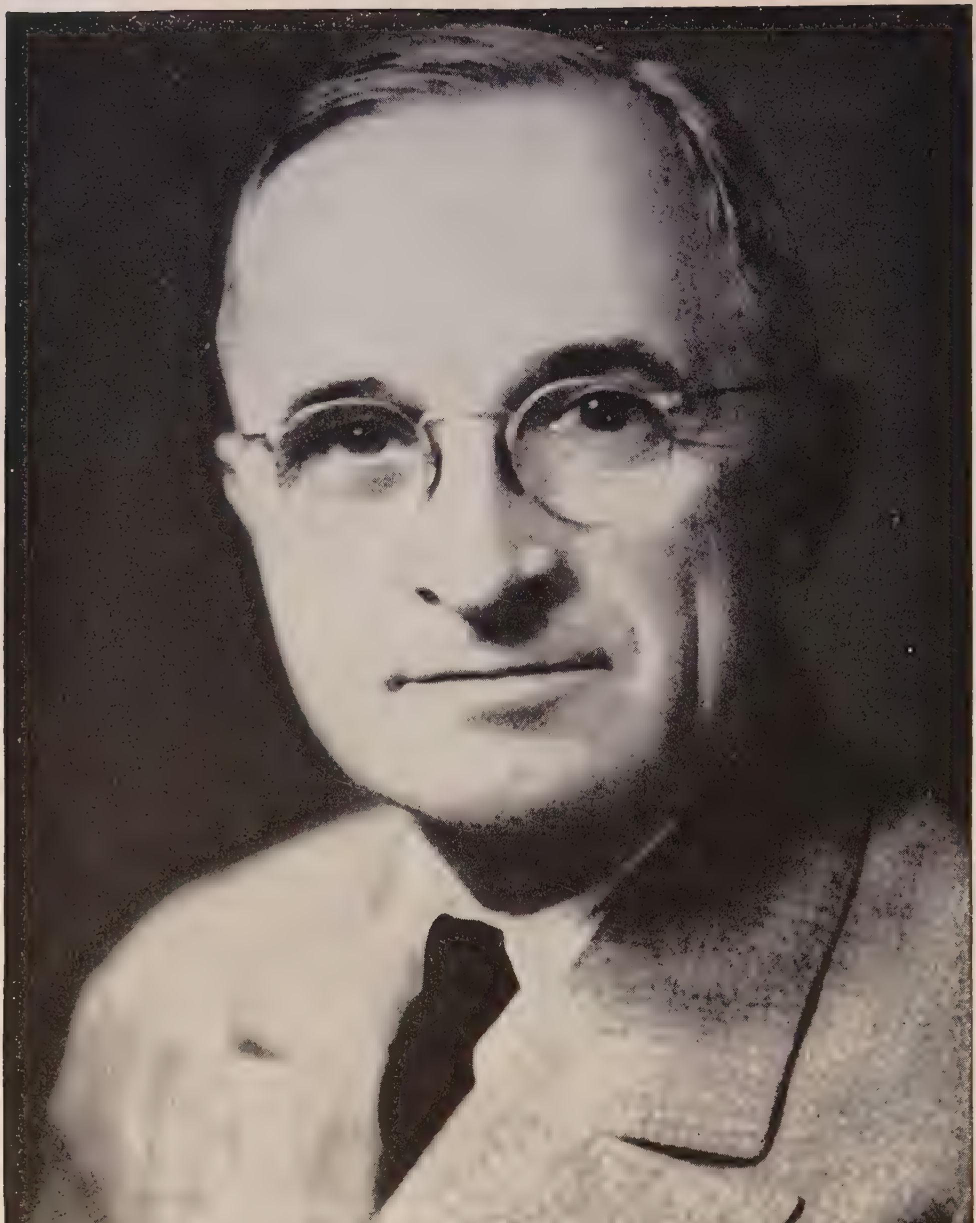
Returning home, Truman married Elizabeth Virginia Wallace, whom he had known for many years and who, as Bess Truman, was to be his constant support in the years to come. Their only child, Mary Margaret, was born five years later, in 1924. Earlier, in 1921, Truman received a hard blow when a haberdashery store he had opened with another army veteran failed and plunged both into debt. He received aid from the local Democratic party, of which both he and his father had long been loyal members, and was given the job of overseer of highways for Jackson County. In 1922, with the support of the powerful Kansas City Democratic "machine" run by Tom Pendergast, he was elected county judge, or commissioner. Although the post was not a judgeship in the judicial sense, Truman studied law for a time, even after he failed to win re-election in 1924.

Truman was elected county judge again in 1926 and held the post until 1934, serving as presiding judge during most of the period. Through his tireless efforts, excellent roads were built throughout the county and new public buildings were erected. The voters listened to Truman's plans and gave him their support. In his own county he became a respected leader. In 1933 he took on, without salary, the job of Federal Reemployment Director for Missouri.

Senator and Vice-President. In 1934 the Pendergast machine backed Harry Truman for the United States Senate. The machine

Major Events During the Truman Administrations

World Affairs		*Domestic Affairs*
Germans surrender (May 7). Labor party victorious in Britain. Hiroshima and Nagasaki hit by atom bombs. Japan surrenders (Aug. 14).	**1945**	Truman takes office (Apr. 12) on death of Roosevelt. United Nations Charter signed at San Francisco (June 26). Bipartisan foreign policy achieved.
First U. N. meetings in London (Jan.). Victor Emmanuel III of Italy abdicates; Italy abolishes the monarchy.	**1946**	Atom-bomb tests at Bikini. Independence of Philippines becomes official.
British carry out program of nationalization. First President of the Fourth Republic elected in France. Partition of India.	**1947**	United States establishes civilian control of atomic-energy development. Truman inaugurates plan to save Greece and Turkey from Communist control. Marshall Plan for European recovery adopted. United States armed forces merged in one Defense Department. Presidential Succession Act.
Communists take over in Czechoslovakia. New state of Israel proclaimed.	**1948**	"Cold war" with Russia. Truman elected; Democrats control Congress. Billions voted for rearmament and aid to Europe.
North Atlantic Defense Treaty signed by twelve nations. Eire cuts last ties with Britain. People's Republic of China proclaimed.	**1949**	Senate ratifies North Atlantic Treaty. Truman pushes "Fair Deal" and aid to backward regions. Inflation makes headway.
First President of Republic of India inaugurated. North Korean Communists invade South Korea (June 25). Unitary Republic of Indonesia proclaimed.	**1950**	Truman orders American sea, air, and ground forces to aid South Koreans.
Chinese Reds take over Tibet. Crown Prince Baudouin succeeds Leopold III as Belgian king. Japanese Peace Treaty signed in San Francisco. Libya becomes an independent state.	**1951**	Ratification of 22nd Amendment, limiting Presidents to two terms. Communism and corruption in government become leading issues. Peacetime conscription expanded.
Elizabeth II ascends the British throne on the death of George VI.	**1952**	Internal Revenue Bureau reorganized. Missouri Valley floods cause great property loss. President's seizure of the steel industry becomes a national issue.



International

HARRY S. TRUMAN
THIRTY-THIRD PRESIDENT OF THE UNITED STATES

was corrupt, but although his political opponents were always to criticize his connections with it, they were never able to accuse him of sharing in its dishonest dealings. As a Baptist, a Mason, a member of the American Legion, and a county administrator with a solid record of achievement and a large following, Truman made a strong candidate. Elected to the Senate as a firm supporter of President Roosevelt, he maintained a humble silence for many months, working diligently to learn the duties of his office.

During his first term as Senator, Truman gained a reputation as a quiet, hardworking legislator and won prestige for his contributions to the Civil Aeronautics Act and the Transportation Act of 1940. He made himself the target for harsh criticism, however, when he opposed the renomination of a district attorney who had exposed corruption in Missouri politics. Further disclosures led to the collapse of the Pendergast machine, which therefore could not be credited for Truman's narrow victory in his fight for re-election in 1940. His re-election proved that his work in the Senate had won him many friends in organized labor and that many others had refused to believe that his long association with, and stubborn loyalty to, the imprisoned Pendergast was a blot on his own honor.

Still troubled by financial difficulties but greatly bolstered by his successful campaign, Truman returned to the Senate to win national acclaim as the chairman of the Special Committee Investigating the National Defense Program. Beginning in 1941, this committee, which was generally known as the Truman committee, saved billions of dollars for the nation by exposing waste, dishonesty, and extravagance in the projects being carried out to support military efforts in World War II. The bespectacled little man with the flat, Missouri twang and the stubborn jaw came to be looked upon as a staunch guardian of the national bank roll in a time of wild spending.

Considerable tension and confusion surrounded the selection of a vice-presidential candidate in 1944, when Franklin Roosevelt decided to run for a fourth term. Finally, Harry S. Truman, who was supporting James F. Byrnes for the post, was himself chosen as the President's running mate. Happy in the Senate, he accepted the honor reluctantly. The ticket triumphed in the November elections. Five months later, on April 12, 1945, Roosevelt died at Warm Springs, Ga., and Harry S. Truman became the first Missourian to be President.

Administration of Truman, 1945-1953

Truman succeeded Roosevelt, a man for whom he had the deepest admiration, with humility and worried concern. The nation at large, while seriously doubting his ability to fill the place of his dynamic predecessor, responded heartily to his plea for support and assistance in the months ahead. On April 25 the new President telephoned a message opening the San Francisco Conference of the United Nations (see NATIONS, UNITED). A few days later, on May 8, he proclaimed Germany's surrender. Before the summer was ended he took part in the Potsdam Conference with the leaders of the British and Russian governments, announced the atomic bombing of Hiroshima and Nagasaki, and proclaimed the surrender of Japan. Until World War II came to this thunderous conclusion (see WORLD WAR II), the rush of history left little opportunity for Truman to demonstrate his personal abilities or to reveal his own political theories. These were brought out in the troubled postwar years.

Acme Photo

PRESIDENT TRUMAN'S WIFE preferred privacy to public life, but their daughter Margaret appeared on the concert stage, on radio, and on television as a professional singer.

Struggle with Congress. In September the President sent a message to Congress which called for legislation following the line of social services identified with Roosevelt's New Deal (see ROOSEVELT, FRANKLIN D.). Thereafter the "honeymoon" of co-operation between the Congress and the President rapidly collapsed. Before the mid-term elections of November, 1946, Congress had forced Truman to rush the process of reconversion from a wartime to a peacetime economy. The military machine was quickly dismantled, and, despite a fight by the President, the elaborate structure of price controls was practically wrecked. While supporting higher wages for workers, Truman enraged the unions by the tactics he used in halting the railroad strike of 1946 — one of many serious work stoppages in this period. Later in the year John L. Lewis and his United Mine Workers were fined for ignoring a court injunction.

By the time of the mid-term elections Truman was under fire from all sides. Republicans and conservative Democrats, chiefly from the South, ignored most of his proposals to Congress. In a period of rising prices and food shortages, he was attacked by conservatives for fighting to keep price controls and by liberals for giving up the fight. Management condemned his support of higher wages, while labor blamed him for interfering with its right to strike. The elections of 1946 brought Republican control in both houses of Congress.

Politics and Diplomacy. Although he showed new determination to stop the spread of damaging strikes, the President proved that he was still labor's champion by fighting the Taft-Hartley Labor Relations Act of 1947. He also heartened his liberal supporters by again calling for expanded government services and special powers to fight inflation. Meanwhile he had assembled about him an official family quite different from that left by Roosevelt. Of the many changes that took place in the Cabinet the most dramatic were the dismissal of Henry A. Wallace, Secretary of Commerce and former Vice-President, for a speech in which he criticized the nation's "tough" policy toward the Soviet Union; and the quitting of Harold Ickes, Secretary of the Interior, over a controversy involving a presidential appointment. In the Ickes incident Truman's defense of his appointee revealed a stubborn loyalty that was to crop up again and again in his political activities. With some notable exceptions the men he appointed to important positions were more apt to be old friends of mediocre talents than first-rate administrators.

The Wallace case was related to the new spirit of aggressive diplomacy which was becoming evident in the Truman administration. The attempt to get along with the Soviet Union, long criticized by some statesmen, was being abandoned in favor of a policy of checking the steady postwar advance of Communist imperialism. To this end, the President in 1947 launched the movement to give economic aid to Greece and Turkey. He also vigorously supported the Marshall Plan, named for his Secretary of State, George C. Marshall, which developed into the European Recovery Program. A later step was the formation of the North Atlantic Alliance, which united the United States, Canada, and the anti-Communist countries of Europe in a mutual defense pact. Meantime there had been a merger of the American armed forces under one department (see DEFENSE, DEPARTMENT OF).

While striking these blows for democracy in the "cold war" with Communism, the President appointed the Hoover Commission, headed by former President Herbert Hoover, to reorganize the Executive Department and called once more for powers to halt the inflationary spiral of rising prices and wages (see INFLATION AND DEFLATION). Early in 1948 he proposed a system of national health insurance, universal military training, and a number of civil-rights measures to protect the interests of racial minorities. Conservatives in general and Southern Democrats in particular hotly contested his program.

The Campaign of 1948. After a group of prominent Democrats had failed to persuade General Eisenhower to accept the Democratic nomination, the party reluctantly nominated Truman. A Southern group known as the "Dixiecrats" put up its own States'-Rights ticket; Henry Wallace led the left-wing Progressive party slate; and the Republicans, confident of victory, nominated Governor Thomas E. Dewey of New York. With his own party only halfheartedly behind him, Truman seemed to have little chance, but the stubborn Missourian was ready and eager to prove his mettle as a fighting politician.

Truman's campaign technique was as simple as it was effective. He took his fight to the people, traveling thousands of miles and delivering hundreds of speeches. To the millions who heard him speak, he announced that Congress — the "do-nothing" Eightieth Congress — and greedy, selfish private interests had deliberately wrecked his attempts to do more for the people and for the nation. He had called Congress back into session to give it a chance to pass necessary legislation, but it had failed to produce. Therefore he was asking the people to give him a new Congress so that he could carry on in their interests. The voters listened to the little man and liked his spirit. When the votes were counted, Harry S. Truman was back in the White House, this time through the will of the American people.

The Fair Deal. Truman had long since stepped out of the shadow of his predecessor, and as the people's elected Chief he announced that his was a Fair Deal rather than a New Deal administration. Again, and more boldly than before, he called for legislation that would raise America's stand-

International News Photo

THE JAPANESE PEACE TREATY CONFERENCE in San Francisco in September, 1951, was a historic occasion not only in its own right but also as the subject of the first coast-to-coast telecast. Here, President Truman delivers the opening address, while Secretary of State Acheson listens.

ard of living, improve housing, assist education, guarantee civil rights for all, provide medical care for all, and, through the Point Four program, assist in the development of backward areas of the world. Naming inflation as the nation's most dangerous internal foe, he asked for controls and higher taxes. But despite his election victory, he still faced a powerful opposition, including Republicans and Southern Democrats, and most of his demands, including repeated calls for the repeal of the Taft-Hartley Act, brought no action.

At mid-century the nation was enjoying full employment and high wage scales; the postwar reconversion had been accomplished with far less difficulty than the experts had expected. But prices were rising steadily, and the government's expenses were enormous. The tense international situation made necessary huge contributions in money, goods, and arms to support democratic European governments and their armies and immense appropriations for America's armed forces. Even when these forces, unified under the Department of Defense, had their budgets restricted by Secretary Louis Johnson, the work on secret atomic weapons continued. Work on an even more devastating hydrogen bomb was also launched.

Armed Conflict Once More. Continued friction between the United States and the Soviet Union, both in and out of United Nations gatherings, made the Truman administration a target for varied criticism. One Congressional wing believed in an isolated defensive position; another agreed with the President that America must place its hopes in the U. N. and in close co-operation with western Europe; a third accused the administration of causing the downfall of the Chinese Nationalist Government and thus "giving" China to the Communists; a few, convinced that war was inevitable, urged an immediate attack on Russia.

In this period there developed a violent campaign, based on charges that the Roosevelt and Truman administrations had failed miserably in their dealings with the Russians, that their inept diplomacy had resulted in the expansion of Soviet power, and that the State Department in particular was honeycombed with Red agents and Communist sympathizers. A flood of charges and countercharges broke loose, and there were hearings, security investigations, and trials. Staunchly defending his Secretary of State, Dean Acheson, the President backed the government's loyalty review board but angrily condemned as "smears" the countless accusations made by Republican Senator McCarthy of Wisconsin.

In June, 1950, the Communist armies of North Korea invaded South Korea. The United States took the lead in bringing the United Nations to the defense of the invaded territory, and American troops were sent to the battle front. With widespread popular support, the President pushed forward the mobilization of men and matériel. Once again America shifted to a wartime economy, with conscription, higher taxes, priorities, and economic controls. General George Marshall replaced Louis

Johnson as Secretary of Defense, and military appropriations multiplied. Early in 1951 Dwight Eisenhower took over as commander of an international force to defend Europe against Communist aggression.

In the Congressional elections of 1950, the Republicans gained ground. Opposition groups charged the administration with being too timid in its foreign policy — and of draining America of its economic and material strength by doing too much. General MacArthur, commander of the United States forces in Korea, repeatedly stated that his government's attempts to avoid all-out war with the Soviet Union were crippling his military strategy. In April, 1951, the President suddenly stripped the General of his commands. MacArthur returned to a hero's welcome, and political strife increased. When investigations turned up evidence of unethical practices in government departments, antiadministration leaders charged that corruption was widespread in Truman's official family. The President's attempts to restore strict price controls were stubbornly resisted, and his legislative proposals continued to get a hostile reception.

Refusing to make another bid for the Presidency, Truman campaigned vigorously for the unsuccessful Democratic candidate, Adlai Stevenson, in 1952. He retired after the inauguration of President Eisenhower; but, while enjoying private life with his wife and daughter, Margaret, he remained an outspoken champion of the Democratic party.

The Truman Era

Harry Truman was President of the United States during one of the most dynamic periods in the nation's history. Like the Coolidge era, it was a time of great prosperity, tremendous production, and an ever-rising standard of living. But these postwar years did not reveal the wild optimism of Coolidge's time. Keenly aware of the dangers threatening their way of life, the American people watched with deep concern the events, foreign and domestic, which might bring on another and more terrible world war. Their worry was reflected not only in a new interest in international affairs but also, at times, in emotional outbursts of fear, hate, and suspicion and in a quest for some sort of easy solution to the world's problems.

World Leader. America emerged from World War II the most powerful and the richest nation on earth. With Soviet Russia as a notable exception, most of the rest of the world looked upon the United States as the natural successor to Great Britain, which could no longer hold its former position as the mighty chairman at the world's conference table. New problems and new responsibilities were forced upon America, which did not ask for the job of leader and was not sure that it wanted it or could handle it.

Actually, America did not fully realize its own strength. It knew it had accomplished production miracles in World War II, but it solemnly accepted the gloomy predictions of its experts that hard times lay ahead. America took on the job of reconversion with enthusiasm. It dismantled its war machine in a rush, and the government, which had owned about one fifth of the wartime industrial plants, retired from business in record time. Reconversion resulted in terrible waste, but it set peacetime industry in motion with few of the expected breakdowns or dislocations.

The Boom Years. Then followed one of the great chapters in the story of American production. To a public starved for peacetime consumer goods, the nation's factories, mills, and assembly lines poured out the most enormous flood of products in history. Hundreds of industries launched huge expansion programs. Steel production surpassed its wartime record. Automobiles, refrigerators, washing machines, radios, television sets, and all the marvels of modern living moved into retail outlets and into consumers' garages and homes by the million. With the great increase in farm machinery and the introduction of new scientific methods of farming, farm production multiplied, so that America could feed itself, feed vast populations abroad, and still have a surplus for storage. Millions of homes were built, and thousands of miles of highways were constructed. New oil wells were drilled, and new pipelines were spread over the nation. Industry produced, and the public purchased, drawing on savings accumulated during the war and on the larger pay checks of the postwar years.

A recession occurred in the Truman era, but the postwar depression the experts had predicted failed to materialize. The chief danger was the inflation spiral, in which prices and wages rose ever higher. Of the more than 150,000,000 Americans recorded in the 1950 census, well over 60,000,000 were employed, and the production rate per worker was higher than that of past years. Organized labor, impressed by the high profits reported by management, struck repeatedly not only for higher wages but also for pension plans and for revolutionary new contracts which tied wages to the cost of living.

The Truman era was an era of spending. The average citizen spent as never before and, as prices continued to rise, found that his dollar bought less and less. Attempts to control prices brought the threat of shortages and black markets. While the stock market soared and the nation's production level climbed ever higher, the government seemed to be unable to live within its budget. Government funds were being poured out in loans, subsidies, and price-support programs to industry and agriculture, in vast appropriations for atomic research, new planes, new weapons, and new military development, and in the most extensive program of foreign aid ever known.

Thieves and Traitors. The economic inflation of the Truman era was accompanied by a moral deflation. Postwar investigations proved that some Congressmen had engaged in shameless profiteering during the world conflict. Later, other public officials were revealed to be petty thieves, receiving "kickbacks" from their employees, and peddlers of "influence," who accepted money or gifts in return for their efforts in behalf of companies and individuals seeking government loans and contracts. Even more shocking to many Americans were disclosures that college basketball players were accepting bribes and that West Pointers were breaking their own code of honor. Finally, the investigations of the Kefauver Committee revealed that professional criminals exerted powerful influence on local and even state governments in various parts of the nation.

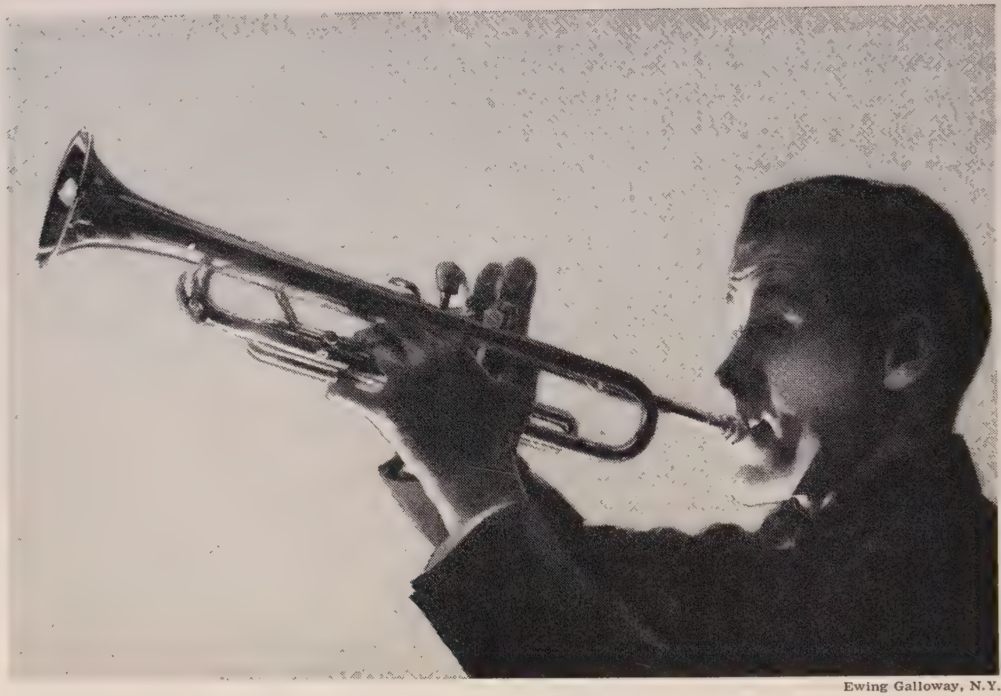
In this same period Americans learned to their horror that some of their fellow countrymen were supplying Soviet Russia with secret information essential to America's security. The trial of Alger Hiss, a former State Department employee who was found guilty of perjury, was one of the sensations of the time. Another was the trial of a number of the leading American Communists. Proof of traitorous activity on the part of a few had the desirable effect of warning Americans of the dangers facing them; unfortunately, it also gave rise to an atmosphere of fear and suspicion which encouraged wild accusations against loyal and honest citizens.

The American Scene. The Truman era was an era of further advances in atomic science, of additional "miracle drugs," of guided missiles, and of planes which hurtled through space faster than the speed of sound. The public read of these wonders with mixed emotions. Science fiction gained great popularity, but so did books which offered escape, religious instruction, or "peace of mind." The fiction of the period included a great many war novels, and there were dozens of books by military and naval officers concerning the various campaigns of World War II. Perhaps the most noteworthy development in the American publishing industry was the tremendous popularity of low-cost, paper-bound books.

The American home in the Truman era was invaded by television, a new medium of entertainment which affected the living habits of millions. A new industry in itself, television created numerous other industries, which turned out products ranging from new home furnishings to accommodate the television set and its viewers to cowboy costumes for the youngsters who longed to dress like their cowboy TV heroes. Canasta, a card game which rose to rival bridge, had to compete for attention with the television screen. The "New Look," a trend in women's fashions which dropped skirt hems almost to the ankles, came and went to a blare of publicity; but television, with a coast-to-coast network in operation and full-color telecasting under way, promised to remain a part of the American scene (see TELEVISION).

By mid-century America had seemingly left far behind the pioneer days of westward expansion, but the census of 1950 proved that the center of population was still shifting west. California was the second state in the Union in population as well as size, and Seattle, Wash., had become one of the twenty largest cities. Americans had much to worry them: Communism threatened the free world; democracy had its enemies at home as well as abroad; the ability of the nation to balance its budget and provide full employment in "normal" times had not been proved; the political tensions and the scientific developments of the time could bring about worldwide catastrophe. But the fears of the 1930's that America had passed its peak, that opportunity was dead, and that the young country had become middle-aged and stagnant — these fears had been swept away. America in the Truman era proved itself to be still young, active, and eager, growing new muscles, picking up speed, providing the free world with a powerful champion — and with a brilliant example of the achievement of a free people.

TRUM′BULL, JOHN (1756-1843), an American painter who recorded many of the principal events of the Revolutionary War, was born in Lebanon, Conn. His father, Jonathan Trumbull, was the governor of Connecticut and a staunch supporter of the colonial cause. After graduating from Harvard, John Trumbull served in the Continental Army and was for a time an aide to General Washington. In 1780 he made his first voyage to Europe and settled in London to study painting under Benjamin West. Here he began his long series of historic American scenes with "Battle of Bunker's Hill," "Declaration of Independence," "Death of General Mont-



Ewing Galloway, N.Y.

BOLD AS BRASS OR SMOOTH AS SILK, the clear voice of the trumpet is featured in dance bands playing both "hot" and "sweet" music.

gomery in the Attack of Quebec," and "Surrender of Lord Cornwallis." Many of the portraits in these scenes were painted from life, and they formed an invaluable record of the period. Trumbull continued to work both in Europe and America, and in 1817 Congress commissioned him to paint copies of four of his famous pictures for the rotunda of the Capitol. Toward the end of his life he gave most of his unsold pictures to Yale and designed the gallery where they were exhibited. His *Autobiography* was published in 1841.

TRUM′PET, a brass wind instrument consisting of a shallow cup-shaped mouthpiece and a narrow cylindrical tube coiled in one or more folds and widening into a medium-sized bell. Its immediate forerunner was the natural trumpet, which had no valves and hence could produce only the harmonic or natural scale (see HARMONICS). The addition of valves, in the early part of the nineteenth century, filled in the gaps in the natural scale, so that a complete chromatic scale could be played. Today the trumpet is the principal soprano of the brass choir in the symphony orchestra.

TRUMPET FLOWER. See BIGNONIA.

TRUST, a legal arrangement by which property is given to a *trustee,* who handles it for the benefit of a third party, or *beneficiary.* Property is any source of income, such as real estate, a sum of money, stocks, or bonds. A trustee may be an individual or a corporation (see TRUST COMPANY). A trust may be a *living,* or *voluntary,* arrangement, in which the owner of the property works out the agreement with the trustee; or it may be set up by the courts, as when a guardian is named. The beneficiary may be a specific individual; at times the one who sets up the trust (trustor) names himself as beneficiary. In the latter case the trustor may wish to be relieved of the burden of investing his own money; the experienced trustee does it for him. A trust may be set up for persons unable to care for their own estates, such as minors or the insane. The trust may be ended when the minor comes of age or the insane person is cured. A person may set his money in trust for the benefit of his family. He may name a trustee to settle his estate for him when he dies. Trusts set up for charitable or educational purposes, in which no specific individual is named as beneficiary, may continue for an indefinite length of time. Other trusts are limited in time by law.

TRUST COMPANY, a financial organization which first developed in the United States. It has been called the "department store of finance" because in practice it performs a wide variety of services. It may act as a trustee (see TRUST); it may invest in and sell bonds and stocks; it may give investment advice; and it may engage in commercial and savings banking (see Banks and Banking). A trust company may also act as an *agent;* that is, it may handle property for an owner without receiving legal title to it, as does a trustee (see Agent). Finally, a trust company may take on the safekeeping of personal property, such as jewelry, stocks, bonds, and other valuables.

In the United States, trustee duties were first associated with insurance companies. Later, around 1900, trust companies began to add banking functions to their trustee duties. Banks met this competition by setting up trust departments. Today both state and national banks may have trust departments. All trust accounts, however, must be kept separate from the regular banking affairs. Trust companies are regulated by state law; their activities are examined by state officials. Trust departments of national banks are examined by the Comptroller of the Treasury, and all those of the Federal Reserve banks are examined by Federal Reserve officials. The Securities and Exchange Commission has further control over the activities of trust companies (see Securities and Exchange Commission).

Trust companies have also grown up in Canada, Great Britain, and other countries. Some English banks have been permitted to add trust privileges to their regular banking business.

TRUSTEESHIP, a system under the United Nations for the administration of certain areas which are not yet able to govern themselves. This International Trusteeship System, which was created by the U.N. Charter (Articles 75 to 91), replaces the mandate system under the League of Nations. Trusteeships are intended to protect the welfare of natives who are not self-governing and to promote their advancement. Each trust territory is administered by a trustee country under the supervision of the U.N. Trusteeship Council, which represents an equal number of trust-administering and nonadministering members of the United Nations. The U. N. Charter provides for "strategic" trusteeship areas in which the trust power may have greater control than in ordinary trusteeship areas because of the "security considerations." For example, the United States has special rights in certain Pacific islands that Japan used as military bases in World War II.

The trust territories are located in Africa and in the South Pacific; most of them were former German colonies which were captured by the Allies in World War I and became mandates under the League of Nations. There are eleven trust territories, as follows: Tanganyika, British Togoland, and Cameroons under Great Britain; French Togoland and Cameroun under France; Italian Somaliland under Italy; Ruanda-Urundi under Belgium; the Territory of New Guinea and the island of Nauru under Australia; Western Samoa under New Zealand; and the Trust Territory of the Pacific Islands, which the United States holds as a strategic trust area. The Union of South Africa has refused to place South-West Africa under a U.N. trusteeship even though this territory was formerly a mandate under the League of Nations. See also Mandate; Nations, United.

TRUSTS, in business, are combinations of several or many separate companies into one organization, under one management. The name *trust* really means a system in which the owners, or stockholders, of each company give their shares of voting stock to a group of men called trustees, in exchange for certificates of membership in the trust. The trustees manage all the companies in the trust and distribute any profits to the various members. The first combination of this kind was the oil trust organized by John D. Rockefeller in 1882. He got so many important companies into the trust that he controlled most of the oil production in the United States. No independent company could compete with his organization.

Monopoly. When a small group controls most of a great industry in this way, it is said to have a *monopoly.* It can fix prices because there are no independent companies to offer the same goods at lower rates. If several independent companies make the same or similar products, customers will buy from the one that sells at the lowest price. Competition keeps prices down.

Because a monopoly like the oil trust prevented competition, fixed prices, and controlled the supply of an essential product, the United States Government in 1909 brought suit against one of the companies in the trust, and the courts ruled that this kind of combination was not legal. After these decisions, other kinds of business combinations took the place of trusts. They are still called trusts sometimes, especially when they seem to be monopolies, but they are organized in different ways.

Holding Company. The *holding company* is a corporation that acquires more than half of the voting stock in various companies and then proceeds to manage the combination under one plan. The individual companies are called *subsidiaries.* The United States Steel Corporation is a holding company with many subsidiaries. They are all separate companies, operating mines, mills, railroads, ship lines, and factories, but they all belong to the parent corporation. A holding company is a legal organization, but if it attempts to prevent competition and establish a monopoly it may be sued by the government and forced to stop such practices.

Some large companies are formed when several smaller organizations decide to join together, or merge. Occasionally one company will buy other companies in the same field of business or in related fields. A large company can often produce goods more efficiently and cheaply than a small one, and size alone does not make such an organization a monopoly.

Combinations. There are two kinds of business combinations in which many companies form a kind of industrial family. The *vertical* combination is one in which the companies include all the various processes from the production of raw materials to the manufacture of finished goods. The Ford Motor Company owns mines, ships, steel mills, forests, railroads, and factories that manufacture automobile parts of many kinds, as well as plants where cars and trucks are assembled. The *horizontal* combination is one in which the companies are all engaged in the same kind of business. The General Motors Corporation is a horizontal combination of many companies that make automobiles, refrigerators, locomotives, trucks, and similar products.

Antitrust Laws. Congress has passed a number of laws prohibiting business methods that stifle competition, hold back production, and raise prices. These regulations apply only to international trade and to interstate commerce, or business that crosses a state line. The first of these laws to control practices leading to monopoly was the Sherman Antitrust Act of 1890. The Clayton Act and the Federal Trade Commission Act, both of which were passed in 1914, were more definite in prohibiting certain business methods in interstate trade. All of these laws are intended to protect the people from the effects of unrestrained monopolies. See also MONOPOLY; ROOSEVELT, THEODORE.

TRYPANOSOME, *trip'uh noh sohm,* a microscopic, one-celled animal that lives in the blood or other body fluids of man, vertebrate animals, and insects. The many kinds of trypanosomes occur throughout the world and are particularly abundant in tropical and subtropical regions. Typically they are slender, spindle-shaped organisms with a wavy membrane extending almost the entire length of the body. Attached to the outer edge of the membrane is a whiplike structure called the *flagellum.* Though many trypanosomes are entirely harmless, there are some species that cause diseases. These diseases are grouped under the term *trypanosomiasis* and include African sleeping sickness and Chagas' disease in human beings, nagana in cattle and other domesticated animals, and dourine, surra, and *mal de caderas* in horses, mules, and donkeys.

Trypanosoma gambiense and *T. rhodesiense* cause African sleeping sickness and are passed from person to person by the bloodsucking tsetse flies (see SLEEPING SICKNESS; TSETSE FLY). Chagas' disease, which occurs mainly in South America, is produced by *T. cruzi.* Trypanosomes of this species are carried by insects known as reduviid bugs. The organisms remain in the victim's blood stream for several weeks and then invade the tissues. While they are in the blood, the usual symptoms are fever, swelling of the lymph glands, and enlargement of the liver, spleen, and thyroid gland. When they invade the tissues, a variety of symptoms is produced, relating to the heart, nervous system, endocrine glands, or whatever other organs are involved. There is no effective treatment for Chagas' disease but many victims recover.

TRYPSIN, *trip'sin.* See DIGESTION.

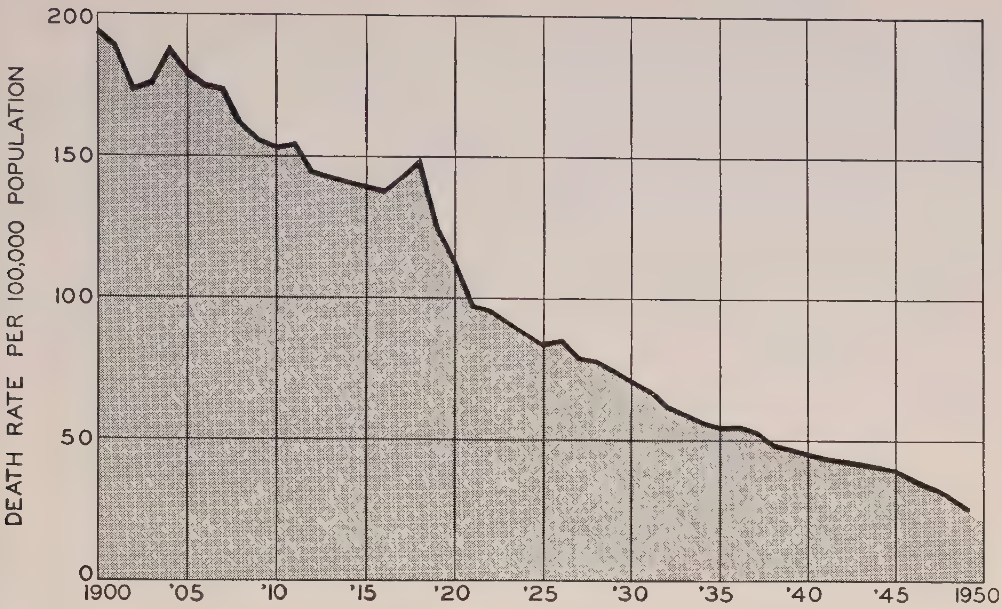
TSETSE, *tset'see,* **FLY**, a bloodsucking insect that carries the organisms (trypanosomes) causing African sleeping sickness in man and nagana in cattle and other domesticated animals. Over twenty species of tsetse flies are distributed throughout the densely forested areas of Africa. They resemble ordinary houseflies but are somewhat larger and overlap their wings when at rest. Both sexes suck blood. Tsetse flies become infected with trypanosomes while biting persons or animals suffering from sleeping sickness or nagana. The trypanosomes develop within the fly's body, and when the fly bites other victims, these organisms are transferred to them. Female tsetse flies do not lay eggs but give birth to larvae. The larvae are deposited in the ground and after undergoing a short pupal stage emerge as adults. Tsetse flies can be controlled to some extent by draining swamps and clearing forests. See also SLEEPING SICKNESS; TRYPANOSOME.

U.S.D.A., Bureau of Entomology and Plant Quarantine

THE MALE TSETSE FLY (left) and the larger female (right) are carriers of sleeping sickness.

Scientific Names. Sleeping-sickness carriers, *Glossina morsitans* and *G. palpalis.*

TSIMSHIAN, *tsim'shih an,* or **TSIMPSIAN**, *tsimp'sih an,* a tribe of Indians originally in coastal British Columbia, where most



National Tuberculosis Association

PUBLIC-HEALTH MEASURES, EDUCATION, and better living conditions have helped to reduce the tuberculosis death rate in the United States. By mid-century the disease killed only about one seventh as many people as it had killed fifty years before.

of them still live. A small group, however, which an English missionary had organized into a model co-operative village, decided in 1887 to remove to Annette Island in southeastern Alaska. Here some seven hundred Indians carry on co-operative industries. From their salmon cannery, their sawmill, and their boat-building enterprise, they support themselves and the village government, maintaining the village power plant, water system, streets, docks, and other improvements. As the Metlakatla Indian Community, they adopted a constitution and charter in 1944.

TSUNAMI, *tsuh nah'mee.* See Tidal Wave.

TU'BA, the lowest-pitched of the brass instruments of the orchestra. It is a large, heavy instrument with a semiconical bore and four or five valves. There are tenor, bass, and double-bass tubas. The tuba was invented in the first half of the nineteenth century. Tubas used in bands are shaped in a wide circular coil so that they can be carried over the shoulder. In this form they are called *helicons.* The sousaphone, a helicon bass, was named for the American bandmaster John Philip Sousa.

TU'BER, a fleshy, rounded underground stem, rich in food, from which new plants grow. The common potato and the Jerusalem artichoke are familiar examples of tubers. Like other stems, tubers have nodes, leaves (though these are scalelike), and buds. A node with its leaves and buds is called an "eye." From the buds new plants rise.

TUBERCULOSIS, *tyoo bur kyoo lo'sis,* also called *consumption,* is a contagious disease that occurs in human beings and some animals. It is caused by a kind of rod-shaped bacteria known as *tubercle bacilli.* Three types of these bacteria have been identified: the *human* type, which is spread chiefly among human beings but may also be passed to dogs, swine, and guinea pigs; the *bovine* (cattle) type, which affects mainly cattle and sometimes man, swine, cats, rabbits, and guinea pigs; and the *avian* (bird) type, which is found among poultry and other birds, swine, and rabbits. Tuberculosis is one of the deadliest of all diseases. In the United States more people die from tuberculosis than from all other infectious diseases combined. During the early part of the twentieth century it was the leading cause of death, but it now ranks about seventh in the list of killing diseases of all kinds.

How It Is Acquired. Human beings can get tuberculosis by breathing in tubercle bacilli or by eating food or drinking beverages that contain the bacteria. Tuberculosis often occurs among those who are in close daily contact with others suffering from the disease. It is also common among those who live in crowded, unsanitary areas. Infected persons may spread the bacteria through the air when they cough, spit, and sneeze, and the bacteria then remain alive outside the body for a long time. Other ways of getting tuberculosis include drinking unpasteurized milk from infected cows and eating from unclean dishes and silverware that have been used by infected persons. The disease is not hereditary, though some families seem more susceptible to it than others. Many people, especially those who live in cities, get tuberculosis and recover from it without ever knowing they have had the disease.

Symptoms and Treatment. Tuberculosis bacteria may attack almost any organ of the body, but most often they settle in the lungs. At first, the person with tuberculosis may not know that he is ill, because very often there are no early symptoms. By the time he begins to spit blood or to realize that his appetite and energy are failing and that he is losing weight, the disease probably is well advanced. No drug for curing tuberculosis has yet been found. But if the disease is discovered early and treated properly, it can be stopped. The best treatment for persons with tuberculosis is complete bed rest in a sanatorium or tuberculosis hospital. Here the patient is under the constant care of trained physicians and nurses, and since he is isolated from others, he cannot spread the disease. Certain drugs are sometimes helpful, among them streptomycin and PAS (para-aminosalicylic acid). Surgical methods are also used; the most common is *pneumothorax.* In this process, air is injected around the diseased lung to collapse the lung and thus give it a chance to heal. When necessary, other kinds of collapse methods may be resorted to. The entire treatment for tuberculosis may take anywhere from six months to several years.

Prevention. To prevent tuberculosis from spreading, those persons who have the disease and do not know it must be discovered and treated. One way of doing this is by making chest X-rays available to the public at no cost. In many parts of the United States trucks equipped with X-ray machines travel about in various neighborhoods and take free chest X-rays of those who want them. Also important in tuberculosis prevention are public-health measures, such as clearing slums, pasteurizing milk, and destroying infected cows. Doctors, nurses, and others who are regularly exposed to tuberculosis and those who live in areas where tuberculosis is common should be given BCG vaccine to help build up immunity to the disease. Since World War II the United Nations has carried on a worldwide campaign against tuberculosis by vaccinating children in those countries where tuberculosis has been a leading cause of death. Each person can build up his resistance to tuberculosis by eating nourishing foods and by getting plenty of rest and fresh air.

TUBE′ROSE, a perennial herb of the amaryllis family, native to Mexico. It grows from a tuber, from which rise a tuft of grass-like leaves and a tall stem bearing a long spike of wax-white, trumpet-shaped, six-lobed flowers about one and one-half inches long. The intense fragrance of the flowers is intolerable to some persons. The tuberose is widely grown, particularly in a double-flowered form, in gardens. It is cultivated also, chiefly in France, as a source of perfume. The tubers are hardy in the southern United States, but in the north it is necessary to dig and store them over winter.

TUBMAN, HARRIET (about 1821-1913), an American slave who became a vigorous leader of the antislavery movement, was born in Maryland, of slave parents. She received no education and worked in the fields as a laborer. In 1849 she escaped and made her way North, eventually settling in Auburn, N. Y. She earned her living as a cook, but her real career was to help other slaves to reach freedom. She was a tireless worker on the Underground Railroad and took many dangerous journeys into the South to act as leader for groups of fugitives. During the War between the States she gave valuable services to the Union forces as a guide and as a spy. She spent her later years in her home in Auburn. See also UNDERGROUND RAILROAD.

TUCSON, *too sahn′,* ARIZ., rich in its historical heritage and enjoying a dry, stimulating climate, is a noted health and winter resort. Sometimes called "Old Pueblo," this city of almost continuous sunshine stands at an altitude of 2,400 feet in southern Arizona, about one hundred miles southeast of Phoenix. Tucson looks beyond its plateau toward rugged mountains. Within and surrounding the city are the strange saguaro cactus forests, old missions, ancient pueblos, and Indian villages.

Tucson has a population of about 45,000, which is greatly increased during the winter months. Throngs of visitors attend the fiesta and rodeo held in February and the yearly fiestas held by the Indians. The attractive buildings of the University of Arizona spread over a seventy-five-acre campus, which is also the site of the State Museum. Both this museum and that of the Arizona Pioneer's Historical Society contain excellent collections. In addition to fine hotels and dude ranches, there are many sanatoriums and a veterans' hospital. Tucson is the seat of Pima County, a rich agricultural and cattle-raising region. Industries for the most part merely service the city.

The gold-seeking explorer Coronado first visited the site of Tucson about 1540 and later it became an Indian settlement. In 1776 a presidio (military post) was located at Tucson. It flourished as a Spanish town, but declined somewhat under the Mexican regime after 1822. The Gadsden Purchase of 1854 placed Tucson under the American flag (see Gadsden Purchase). As a frontier town, with the Apache Indians still on the warpath, Tucson was closely identified with "Wild West" days. Both Confederate and Union troops occupied it during the War between the States. It served as territorial capital from 1867 to 1877 and became a city in 1883.

TU'DOR, House of, an English royal family which included Henry VII, Henry VIII, Edward VI, Mary I, and Elizabeth I. The founder of the dynasty was Owen Tudor, a Welsh squire at the court of Henry V. After the death of the King, Owen Tudor married the widowed queen, Catherine of Valois. Their eldest son, Edmund, who was created Duke of Richmond, married Margaret Beaufort, a descendant of John of Gaunt, head of the House of Lancaster. Henry Tudor, the son of Edmund and Margaret, came to the throne of England in 1485 as Henry VII, after defeating the Yorkist Richard III at Bosworth Field. He ended the Wars of the Roses by marrying Elizabeth of York. The royal line of Tudors ended with the death of Queen Elizabeth in 1603, but the Stuart kings, who succeeded the Tudors, claimed the throne because of their descent from Henry VII. See also Edward (VI, England); Elizabeth; England, *History;* Henry (VII, VIII, England); Mary (I, England); Roses, Wars of the.

TUDOR STYLE, the name given to a transitional form of English architecture and design that had its great period during the reigns of the early Tudor rulers, from 1485 to 1558. At this time the landed gentry and the rich merchants of the towns began to demand spacious, comfortable homes. The Tudor house usually had many casement windows, large rooms, and much decorative detail. A great deal of wood was used for paneling, for beautifully carved staircases, and for decoration on the exterior of the house. The Tudor style was essentially Gothic in the late English manner.

TUESDAY, *tyuz'dih,* the third day of the week, named for Tyr, in Norse mythology the god of war. He was also called Tiw or Tiu, hence the form *Tuesday.* In French the third day of the week is *Mardi;* it was named for Mars, the Roman god of war. *Shrove Tuesday,* the day before Ash Wednesday, derives its name from the fact that in former times church bells were rung on that day, summoning Christians to confess their sins and receive shrift (absolution) in preparation for Lent. See also Shrove Tuesday; Week.

TUGBOAT, a small, sturdy vessel with powerful steam or diesel engines, used for towing. Tugboats aid large vessels in docking and other maneuvers, and they move barges and various kinds of floating equipment not moved by power. Some tugboats are large and powerful enough to make sea voyages. River tugboats are called *towboats* in the United States. They move strings of barges, sometimes several hundred feet long, not by towing but by pushing. By pushing the barges, rigidly connected so as to form a unit, the towboat has better control over them in passing through locks and narrow, winding channels.

TUILERIES, *twe'lur ihz,* The, a royal palace begun under the orders of Catherine de' Medici about 1564, stood west of the Louvre on the right bank of the Seine in Paris. Henry IV extended the south wing of the Louvre to meet the corner of the Tuileries, and in the nineteenth century the north wing was also extended, so that the two palaces formed an enclosed court. The Tuileries palace was seldom occupied by royalty during the eighteenth century, but Louis XVI and his family were forced to stay there during the early part of the Revolution. It was used again when the Bourbons returned to the throne, but in 1871 it was burned. Only the gardens remain as one of the beautiful public parks in the center of the city. See also Louvre; Paris.

TULAREMIA, *too luh re'mih uh,* or **RABBIT FEVER,** an infectious disease caused by a species of bacteria called *Pasteurella tularensis,* or *Bacterium tularense.* Tularemia is found not only among human beings but also among rabbits, hares, squirrels, rats, mice, birds, and many other wild animals. It is transmitted from animal to animal by the bites of infected ticks and deer flies. Humans may also acquire the disease in this way, but more often they get it by handling infected rabbits, by eating poorly cooked meat from infected animals, by drinking contaminated water, or by other means.

The earliest symptoms of tularemia appear one to ten days after the bacteria have entered the body. The disease begins suddenly with fever, headache, vomiting, weakness, and recurrent chills followed by sweats. As it progresses, an ulcer forms at the site of infection and nearby lymph glands swell and may become abscessed. In some cases the eyes, lungs, or other organs are involved. Tularemia is diagnosed by finding the bacteria in the patient's blood or in the ulcers and usually can be treated successfully with streptomycin. Though convalescence is slow, most victims eventually recover. Tularemia occurs most often among hunters, farmers, butchers, cooks, and housewives who have skinned or otherwise handled infected rabbits. It can be prevented by wearing rubber gloves while skinning game animals, by cooking the meat thoroughly, by discarding rabbits whose internal organs contain whitish

W. Atlee Burpee Co.

FANCY COUSINS OF THE COMMON TULIP (center) are the double tulip (left) and the parrot tulip (right).

spots, and by shooting rabbits only when they are on the run. Animals that do not run when approached are probably sick and should be avoided.

TULIP, any of a genus of showy flowering plants of the lily family. Tulips are bulbous plants with swordlike leaves and erect stems terminating in cup-shaped flowers, which appear in pastels and deep tones of red, yellow, and purple in both solid and mixed colors. They were apparently first cultivated in Turkey, whence they were introduced into Europe in the middle of the sixteenth century. The interest they aroused culminated in the "tulipomania" that swept the Netherlands from 1634 to 1637, when stock companies were organized to purchase single bulbs. Thousands of persons were ruined in 1637, when the government voided all contracts. The Netherlands still is the leading producer of tulip bulbs, but Dutch firms have established branches in the Puget Sound area of Washington, and large quantities of bulbs are produced also around Holland, Mich.

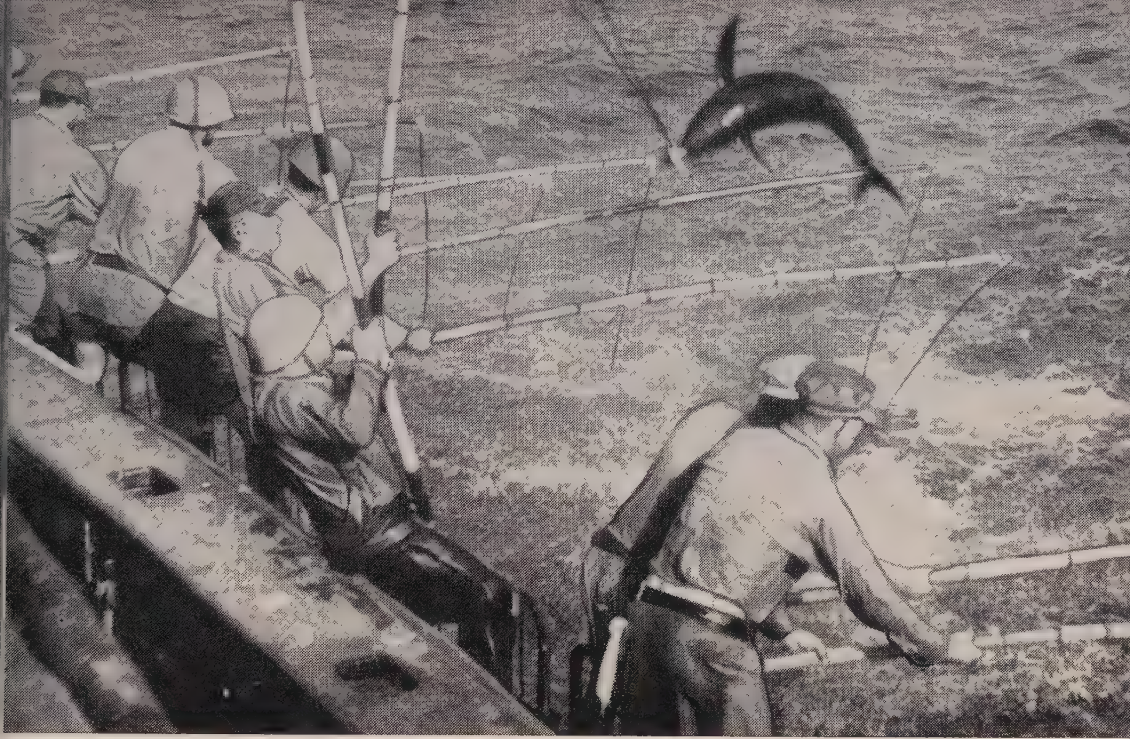
TULIP TREE, a valuable deciduous tree of the eastern United States and southern Canada. It is notable for its valuable wood, its tuliplike flowers, and its great size. Well-grown specimens may exceed 150 feet in height. The tall trunks of tulip trees can be made into boards of exceptional width, up to eight feet. The wood is commonly called "yellow poplar," though the tree is not related to the poplars but to the magnolias. The wood has an even grain and is easily worked. It is used for furniture, veneer, interior trim, boxes, and crates.

TULSA, Okla., widely known as the "Oil Capital of the World," is situated in the fertile valley of the Arkansas River, in northeastern Oklahoma. Tulsa is the headquarters of nearly five hundred companies that produce, refine, transport, or market petroleum products. They jointly control one fourth of the nation's oil production. The International Petroleum Exposition, which meets in Tulsa every second year, draws visitors from every part of the world. The city is also the commercial and financial center of eastern Oklahoma, which is rich in coal, lead, zinc, commercial clays, and natural gas.

When oil first gushed from wells at Red Fork in 1901, Tulsa was a village of about 1,400 inhabitants; it is now the second largest city of the state, ranking next to Oklahoma City. Handsome skyscrapers rise high above the river, and there are fine parks and playgrounds. Tulsa was a meeting place for the Osage, Cherokee, and Creek Indians in early times, and there are still many reminders that this is Indian country. Many citizens of Tulsa are proud of their Indian ancestry. The Philbrook Art Center and Indian Museum and the Gilcrease Foundation Galleries of Indian History commemorate the Indian contribution to the state. Tulsa was reached by the railroad in 1882. It was chartered as a city in 1902, after the discovery of oil, and is the seat of Tulsa County. Its situation on main lines of north-south and east-west transportation makes it an important junction for rail, air, and highway travel. The population is about 181,000.

TUMBLEBUG, any of several scavenging beetles which live on dung and other decayed matter. Close relatives of the famous scarabs, the common tumblebugs are round-bodied insects, black or metallic-colored and measuring about an inch in length. They get their name from the motions they make while rolling balls of dung. The eggs of these beetles are laid on the dung balls, and the balls are then buried in the ground. When the larvae hatch from the eggs, they feed on the dung. See also Scarab.

TUMBLEWEED, the name for various plants whose branches curve to give them a rounded form as they near maturity, when



Westgate-Sun Harbor Company

IN A SCHOOL OF LARGE TUNA, the fishermen team up in pairs, using two poles and lines attached to a single hook. When a fish strikes, both men heave the heavy catch into the boat.

they break off near the ground and are blown about by the wind, scattering seeds as they travel. In the United States they are most prevalent in the open spaces of the West. Among tumbleweeds are the *tumbling pigweed,* a species of amaranth, the *Russian thistle,* and the *tumbling mustard.*

TU′MOR. In its widest sense, the medical term tumor means a swelling in any part of the body. More specifically, however, a tumor, or *neoplasm,* is a swelling caused by the growth of new tissue, which has no special function of its own and is not dependent on the organs surrounding it. Very often it interferes with the normal functioning of the body. Tumors, which can occur anywhere in or on the body, may be made of any type of tissue (see TISSUE) and are often named or classified according to their tissue structure. They may be either *benign* or *malignant.* Benign tumors, such as the common wens, nasal polyps, and fibroid tumors, do not usually grow again once they have been removed by surgical operation. Malignant tumors, like those in cancer, have a tendency to grow again after removal and therefore are a serious problem.

TUNA, *too′nuh,* or **TUNNY**, *tun′ih,* a well-known food and game fish. Tuna are found in the temperate waters of the Atlantic and Pacific oceans, the Mediterranean Sea, the North Sea, the Indian Ocean, the Caribbean Sea, and in Japanese waters. Because of their wide distribution they support valuable fisheries in many countries, chiefly the United States, Japan, the Mediterranean countries, and many Latin-American countries. Tuna have a torpedo-shaped body, crescent-shaped tail, and are silvery white underneath, dark blue above. Little is known of their spawning and migration habits.

Commercial Fisheries. Four kinds of Pacific tuna are taken commercially: *yellowfins* and the smaller, less valuable *skipjacks,* which comprise the bulk of the United States and Japanese catches; *bluefins,* which also occur in the Atlantic and are highly prized as game fish; and *albacores,* the expensive white-meat tuna sometimes called "chicken of the sea." *Bonitos,* smaller members of the tuna family, are also taken but are sold as bonito rather than tuna. Bluefins are the largest of the group, occasionally weighing as much as 1,500 pounds.

Tuna fishing is carried on in boats, or *clippers,* which range in length from 80 to 150 feet and are equipped to travel thousands of miles in the search for tuna. When a tuna school is sighted, sardines, herring, or other live bait are thrown overboard to lure the fish to the boat. Standing on small platforms on the sides of the clipper, the fishermen then haul in the catch. Their gear consists of a bamboo pole and a short line fitted with a feathered, unbarbed hook. The fish may also be caught by seining and trolling. The tuna catch is stored in the refrigerated hold of the clipper and taken to port. In the cannery the fish are cleaned, dressed, and precooked in steam ovens. The meat is then stripped off, graded according to the size of the pieces and the color, and packed in tins. The tins are then sealed, and the meat is cooked a second time. The scraps are made into fish meal and fish oil. Vitamin oils are extracted from the livers.

Scientific Names. Yellowfin, *Neothunnus macropterus;* skipjack, *Katsuwonus pelamis;* bluefin, *Thunnus thynnus;* albacore, *Germo alalunga;* bonito, *Sarda chiliensis.*

TUNDRA, *tun′druh,* flat, boggy regions at the northernmost limit of plant growth in Europe, Asia, and North America. During most of the year the tundra is solidly frozen. In summer it thaws to depths of from two inches to two feet, but the subsoil remains frozen. Lichens and moss predominate in the vegetation, but low shrubs and stunted trees also grow. In summer flowers bloom, and in the fall berries provide food for birds and other animals. In many regions reindeer are pastured on the tundra. See also BOG.

TUNG OIL, a valuable oil obtained from the seeds of a medium-sized tree native to China. It is a “drying oil,” one which forms a tough, elastic skin when exposed to the air in a thin film. This skin is waterproof, resistant to acids and alkalies, and little subject to cracking. These properties make tung oil a valuable ingredient in high-grade varnishes, paints, and lacquers, and in waterproof protective coatings for linoleum, artificial leather, and paper bags and cartons. Tung oil is used also in manufacturing certain plastics and some kinds of wallboard. China is by far the world’s leading producer of tung oil. Tung nuts are produced also in the southern United States, chiefly in Mississippi, Louisiana, and Florida, but the oil obtained from domestic nuts is only a fraction of that required by American industry.

TUNG′STEN, a metallic element of considerable industrial importance, discovered in 1781 in the form of scheelite (calcium tungstate, $CaWO_4$). It is used extensively in the manufacture of tough steel alloys. The metal itself, dull white, gray, or silvery in color, was first isolated in 1783. Its name is made up of the Swedish words for “heavy” and “stone,” but its chemical symbol, W, comes from its German name, *wolfram.* The chief mineral sources of the element are scheelite and wolframite, a tungstate of iron and manganese. Important deposits of the ores occur in China, Burma, Bolivia, Brazil, Spain, Australia, and the United States, especially in California, Idaho, and Nevada.

Properties and Uses. The atomic weight of tungsten is 183.92, its atomic number 74 (see ATOM), and its specific gravity 19.3. It has the highest boiling point (5900°C.) and the highest melting point (3370°C.) of all the metals and hence has a very low vapor pressure, that is, little tendency to evaporate. This property makes the metal useful for filaments in electric-light bulbs, radio and other electronic tubes, and for the targets in X-ray tubes. By proper working and heat treatment the brittle metal becomes malleable and so ductile that it can be drawn into exceedingly fine wires. It is very hard, has high electrical conductivity, does not oxidize in air unless the temperature is very high, and is not easily corroded as it is not dissolved by any solvent but a mixture of nitric and hydrofluoric acids. It can be used therefore for crucibles, phonograph needles, contact points in make-and-break circuits, and the electrode metal in arc welders, and also in the manufacture of telegraph keys, spark plugs, and distributors.

Compounds. Several tungsten compounds have commercial value. Sodium tungstate is used to make cloth waterproof and fire-resistant, and both the magnesium and the calcium tungstates can be used in fluorescent lamps and for luminous X-ray screens. Tungsten carbide, one of the hardest substances known, is a good, but brittle, abrasive. Cemented tungsten carbide, or carboloy, is an alloy with cobalt that makes superior high-speed cutting tools and can be used for bearings that must withstand much heat and pressure.

Alloys. The chief use of tungsten is in the manufacture of hard and tough steel alloys. Hacksaw blades, drills, reamers, milling machines, and other cutting tools made from tungsten steels stay sharp and true longer than those made of other steels. Chromium added to the alloy permits higher working temperatures, hence greater machine speeds and greater production. Tungsten steels containing carbon, cobalt, chromium, or molybdenum make excellent permanent magnets for use in electrical instruments and telephone and radio equipment. Stellite, a very hard and corrosion-resistant alloy of tungsten, chromium, and cobalt, is used for cutting tools and surgical instruments and inside machine-gun barrels. Alloys of tungsten and copper are used for electrical contacts that must carry large currents. See also PERIODIC TABLE.

TU′NICATE. See SEA SQUIRT.

TUNING FORK, an instrument that provides the accurate standards of pitch that are necessary for tuning musical instruments. It is really a musical instrument having only one note. A tuning fork is also used for demonstrating phenomena in sound and for acoustical research. It is a U-shaped bar of cast steel with a stem extending below the base of the U. Invented in 1711 by Handel’s trumpeter, John Shore, it was greatly developed and improved by K. R. Koenig (1832-1901).

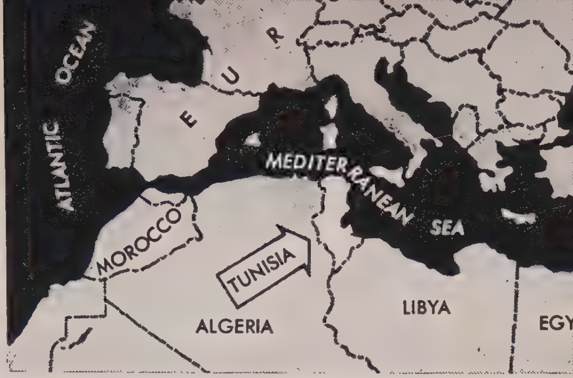
A tuning fork mounted on a resonating box and struck gently with a soft hammer gives a pure, sweet, but rather thin tone that consists only of the fundamental, or lowest, frequency (vibrations per second). If the fork is struck sharply with a hard body, an unpleasant clang tone arises from an overtone with a frequency that has no simple numerical relation to the frequency of the fundamental. A violin note of the same pitch has a much richer sound because many harmonious overtones are present. Sound waves from a mounted fork can set another one of the same pitch into vibration, or even the strings of a piano. See Sound.

A *tonometer* is a set of forks, all different in pitch, by which it is possible to determine accurately the number of vibrations per second made by any sounding instrument within the range of the tonometer. Koenig made a tonometer of 156 forks that have a frequency range from 16 to about 21,845 vibrations per second.

TU'NIS, capital of Tunisia since the ninth century, stands at the head of a shallow lagoon near the Gulf of Tunis. A ship canal dug through the lagoon allows ships to dock at the edge of the city. The old, native quarter, picturesque with palaces, mosques, and bazaars, lies on a hillside. The French section is built on flat ground between the old city and the lagoon. It has paved streets and modern office buildings, hospitals and libraries. A few miles outside the city lie the ruins of ancient Carthage and Roman aqueducts. Tunis is an important trade center and seat of Moslem learning. Its population is about 365,000.

TUNISIA, *tyu nizh'ih uh,* is a country of North Africa. It is bounded on the west by Algeria, on the north and east by the Mediterranean Sea, and on the southeast by Libya. Tunisia has an area of about 48,500 square miles and a varied topography. The Atlas Mountains extend into the northern part of the country and create fertile valleys, of which the Medjerda River valley is the most important. Mountain forests yield cork; valley farms produce wheat, barley, oats, grapes, oranges, and lemons. Grain is raised also on Tunisia's high central plateau, and alfa (esparto) grass for making paper grows there. The eastern coastal plains produce olives, almonds, citrus fruits, pistachios, and grapes. The southern part of Tunisia lies in the Sahara Desert; here are oases with date palms and olive trees. Tunisia's climate is generally mild, with rainy winters and hot summers.

The People. About 90 per cent of Tunisia's 3,500,000 people are native Berbers and Arabs. There are about 70,000 native Jews. The European inhabitants are mainly French and Italian, with a smaller number of Maltese. The natives are Moslems and most of them speak Arabic, though some Berber tribes speak their own dialects. Farming and stock raising are the chief occupations of the natives. Some of the European settlers also farm, but most of them live in the capital, Tunis, and in Sousse, Bizerte, Sfax, and other large cities.



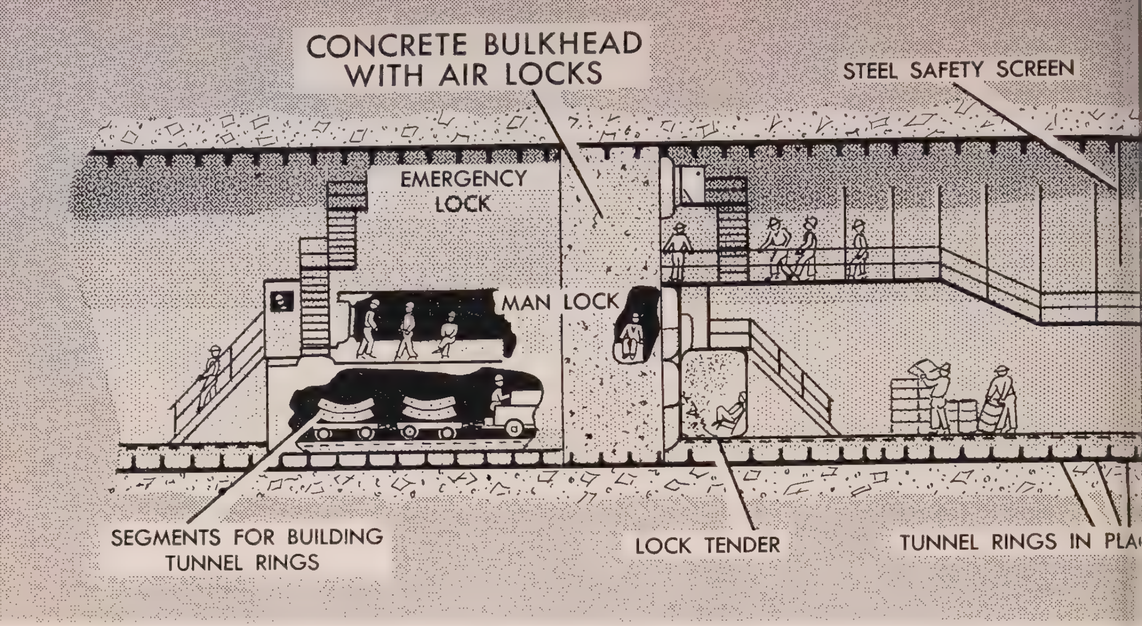
TUNISIA EXTENDS FARTHER NORTHWARD into the Mediterranean than any other African territory.

Industry. During the French protectorate the country's communication and irrigation systems were expanded, and factories for the production of textiles and leather goods were built. Agriculture is the chief industry of Tunisia; important exports are cereals, olive oil, and wine. Mining is another of the country's leading industries, and phosphates, iron, lead, and zinc are exported.

History. The ancient Phoenicians founded Carthage near the site where Tunis now stands. In 146 B.C., Carthage and the surrounding territory fell to the Romans. In the fifth century the Vandals invaded the country. The Arabs took over control of the region in the seventh century and held it against European attack through the Middle Ages. In the late sixteenth century Tunisia became a province of the Turkish Empire. Throughout the eighteenth century it was a pirate stronghold.

During the nineteenth century Great Britain, France, and Italy were rivals for control of Tunisia. In 1881 France seized Tunis and, in the same year, signed a treaty making Tunisia a protectorate of France. In the 1930's the Destour (Constitution) Party, made up largely of the French-educated Moslem middle class, made demands for a more democratic form of government. In 1934 the Neo-Destour faction split off from the conservative nationalists and clamored for home rule.

During World War II, Tunisia was a battleground between Allied and Axis forces. Nationalist agitation continued after the war, leading to promised reforms which were not always effected. After an attempt by the Tunisians to bring their problems before the United Nations, France seized Neo-Destour leaders and used other repressive measures. Violence broke out in 1952; it was quieted in 1954 by French concessions and a promise of Tunisian home rule. In 1956 France and Tunisia signed an agreement for Tunisian independence. See Africa (maps); Bar-



WORKERS CALLED SANDHOGS tunnel under rivers, lakes, and bays. Compressed air . . .

BARY STATES; CARTHAGE; TUNIS; WORLD WAR II.

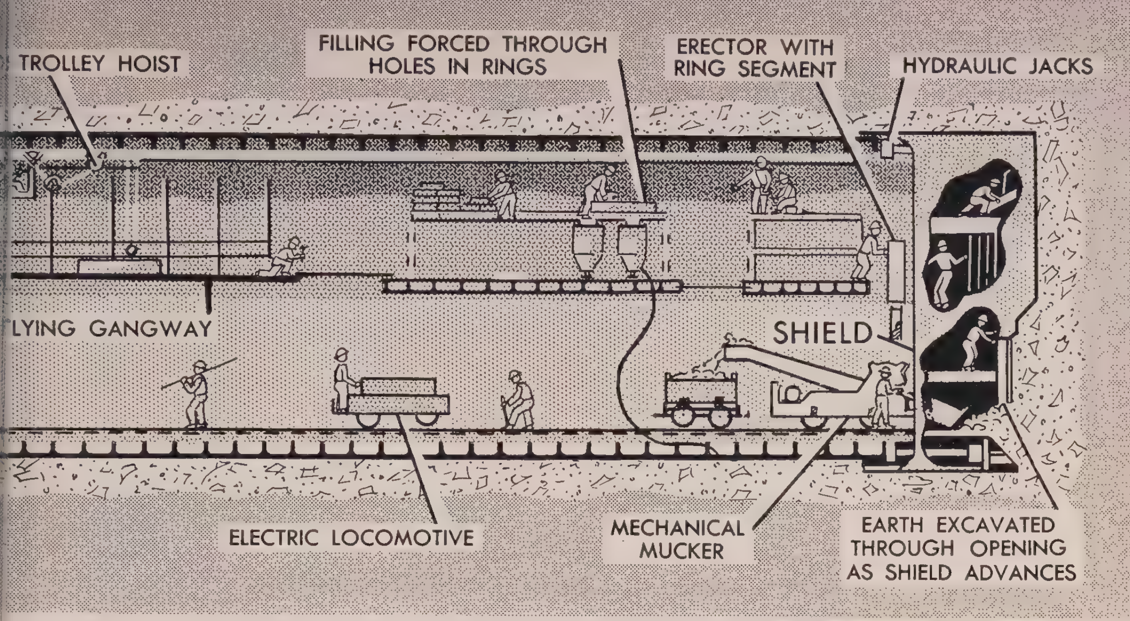
TUNNEL, a generally horizontal underground passage. Tunnels are indispensable in mining, and they are essential to efficient operation of modern transportation. They carry railways and highways through mountains and under rivers and lakes, and they convey water to communities far distant from the source. In a number of cities subways are an important part of the transportation system; tunnels also carry municipal gas mains, electric cables, water pipes, and sewage conduits.

Some underground passages are dug down from the surface and the excavation thus made is covered, but this process is trenching rather than tunneling. True tunneling consists in boring through the earth without disturbing the surface. To speed their construction, tunnels are often driven from opposite ends. Where practicable, a number of shafts may be sunk along the tunnel route, thus permitting the work to be carried on simultaneously at several points. Where it is impracticable to sink vertical shafts, a small "pioneer" tunnel may be driven parallel to the tunnel route and a short distance from it. By means of crosscuts from the pioneer tunnel, work on several sections of the tunnel may be done at the same time.

Rock Tunnels were formerly driven as a number of separate galleries, so that several crews could work at the same time. Modern mechanical advances make it more practical to drive the entire tunnel "face" at one time, that is, the portion under excavation. The section immediately behind it, where timbering and other work is in progress, is the "heading." The face is drilled with automatic drills, or "drifters," mounted on a "jumbo." This consists of a tier of platforms carried on a car that runs on a track. Dynamite is packed in the drill holes, the jumbo is withdrawn, and the face is blasted. To make the force of the explosive more effective, the drifters in the center of the face are inclined toward one another so as to enclose a cone of rock, and successive rings of horizontal holes are drilled about the central portion. First the central section of the face is blasted. Because the force of the explosion is more concentrated at the narrow end of the cone, the rock is blasted outward. This leaves a cavity into which the rock surrounded by the next ring of holes may be driven. The other rings of holes also are blasted in succession.

The shattered rock is scooped up by a "mucking machine" (all spoil removed in tunneling is "muck") and loaded on cars which are hauled away by an electric locomotive. The new heading is braced, usually with steel beams or ribs, and is then lined with reinforced concrete, brick, or other material.

Earth Tunneling. Here the problem is not so much the difficulty of removing the face as it is of preventing cave-ins. This danger is eliminated by use of the "shield," a cylinder slightly larger than the diameter of the tunnel, with a very hard, sharp, cutting edge at its forward end. Powerful hydraulic jacks drive it through the earth like a giant biscuit cutter. Its front end is sealed off by a strong partition in which are a number of hydraulically operated gates. In soft mud one or more gates are opened as the shield is advanced, and the mud oozes backward like tooth paste squeezed from a tube. The mud


TROLLEY HOIST
FILLING FORCED THROUGH HOLES IN RINGS
ERECTOR WITH RING SEGMENT
HYDRAULIC JACKS
LYING GANGWAY
SHIELD
ELECTRIC LOCOMOTIVE
MECHANICAL MUCKER
EARTH EXCAVATED THROUGH OPENING AS SHIELD ADVANCES

Courtesy *Popular Science Monthly*

. . . fills the entire area between the shield at right and the locks at left.

ribbons are sliced with wires and loaded on cars to be hauled away. In more solid earth it is necessary for workmen to excavate the material in front of the diaphragm, often by means of pneumatic shovels and scrapers, and blasting may be necessary to remove rocks and boulders. When tunnels are constructed under rivers and lakes, a bulkhead is built across the tunnel and the work is done under compressed air, which holds back the mud and water and prevents flooding of the tunnel.

After each advance of the shield, segments of a strong, steel lining ring are bolted into place within the tail of the shield. Thus the tunnel is actually constructed within the protecting shield. When the steel lining ring is in place, it is lined with reinforced concrete or other material.

Large Man-Made Tunnels		Length in Miles
Railroad	**Location**	
Simplon	Italy-Switz.	12.3
Apennine	Italy	11.5
St. Gotthard	Switz.-Italy	9.3
Loetschberg	Switzerland	9.0
Mont Cenis	France-Italy	7.97
New Cascade	Washington	7.79
Water		
Delaware Aqueduct	New York	85.0
Colorado R. Aqueduct	California	79.4
Vehicle		
Broadway	Oakland, Calif.	2.8
Mersey	England	2.2
Holland	New York-New Jersey	1.8
Canal		
Rove Ship Canal	France	4.5

TUNNY. See TUNA.

TUPPER, SIR CHARLES (1821-1915), Canadian statesman and leader of the Conservative party, was born in Amherst, Nova Scotia. After taking his degree in medicine at the University of Edinburgh, he returned to Nova Scotia to practice his profession. His election to the Nova Scotia assembly in 1855 marked the beginning of a long career in politics. He served in the provincial government for some years, and from 1864 to 1867 he was premier of the province. Sir Charles took a leading part in the discussions leading up to the creation of the Dominion of Canada in 1867, and in 1870 he was named President of the Privy Council. During the next quarter of a century he held many important posts, serving as Minister of Inland Revenue, Minister of Customs, Minister of Public Works, Minister of Railways and Canals, Finance Minister, and High Commissioner for Canada in England. From April, 1896, to the following June, when his party was defeated in the elections, he was Prime Minister of Canada. Four years later he failed to be re-elected from his constituency in Nova Scotia and retired from public life. His autobiography, *Recollections of Sixty Years,* was published in 1914.

TUR'BAN, a form of headdress worn by many men in the Arab countries and in Iran, India, and nearby parts of the world, particularly by those of the Mohammedan faith. The turban consists of a scarf wound tightly around the head, often over a felt skullcap. The material is generally linen, cotton, or silk, and the scarf may be from six to thirty inches wide and from five to fifty yards long. There are many kinds of turban, each indicating something about the religion, rank, or caste of the wearer. High dignitaries often add jewels or aigrettes as decoration.

TURBINE, *tur'bin,* a rotary engine driven by a fluid (gas or liquid) under pressure.

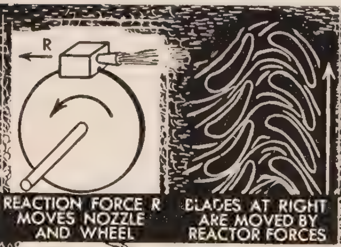
It consists of a rotor, or wheel, mounted on a central shaft and carrying curved vanes, or blades, mounted on its rim; a series of nozzles that direct jets of fluid against the blades; and a casing that encloses the whole. Turbine shafts are connected so as to drive electric generators or other machines. The turbine thus transforms the pressure and velocity energies of the fluid into electrical or mechanical energy.

An *impulse* turbine is driven by the force of the fluid jet striking against its blades. The action is like that of a stream of water from a fireman's hose pushing against the sectors of a revolving door. In a *reaction* turbine the fluid gains speed as it moves through the blade passages. The motion of the blades is their reaction, or kick, against the fluid leaving them, similar to the action of a rotary lawn sprinkler. The blades, or buckets, of both types of turbines are curved so as to reverse the flow of the fluid and permit it to leave the wheel freely.

Hydraulic Turbines are used extensively in large-scale hydroelectric plants. These plants have a very high efficiency and account for about one fourth of all power production in the United States outside of that produced by ships, locomotives, and motor vehicles. Small units can be used as fluid motors for hydraulic machine drives. The impulse type of hydraulic turbine is used where there is a high head of water from a waterfall or a reservoir above the turbine. The water is directed against the buckets of the wheel by nozzles so shaped as to convert the large potential, or static, energy of the water into kinetic, or velocity, energy. One installation of this type with a 2,200-foot head develops 70,000 horsepower (h.p.) at a speed of 250 revolutions per minute (rpm).

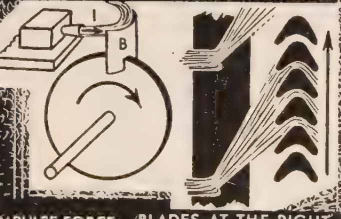
In the reaction turbines used with smaller heads, part of the energy transformation of the water into kinetic takes place in the vane passages and results in the reaction force on the vanes. Each reaction turbine at Hoover Dam, where the head is about 480 feet, makes 180 rpm and develops 115,000 h.p. The *underpressure* turbine, which has a propeller-shaped rotor driven by water falling through it under suction, is used with very low heads. At Bonneville 66,000 h.p. is developed with a head of 50 feet.

Steam Turbines have many advantages over reciprocating steam and gasoline engines, in which pistons move to and fro in cylinders. The turbines are more compact, run smoothly and with little vibration, even at high speeds, and can therefore be built on lighter foundations. They have no rubbing parts except bearings, hence need less lubrication and maintenance attention. They



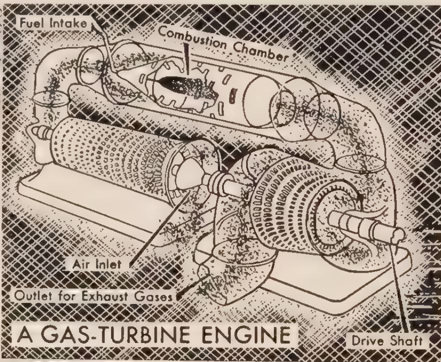
REACTION FORCE R MOVES NOZZLE AND WHEEL

BLADES AT RIGHT ARE MOVED BY REACTOR FORCES

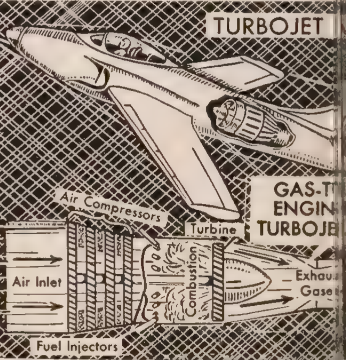


MPULSE FORCE I MOVES BLADE B AND WHEEL

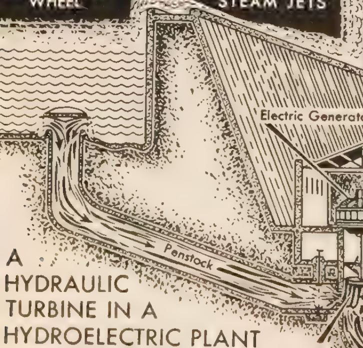
BLADES AT THE RIGHT ARE MOVED BY IMPACTS (IMPULSE FORCES) OF STEAM JETS



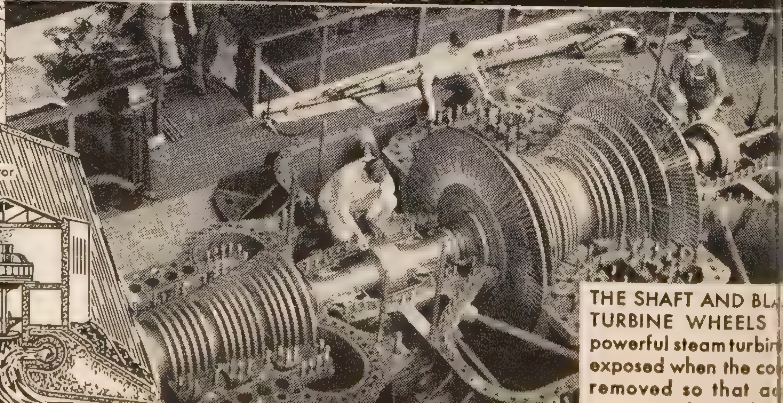
A GAS-TURBINE ENGINE



THE FORWARD MOMENTUM OF A JET-PROPELLED PLANE is the reaction of a pla momentum of the high-speed jet of exhaust gases discharged at the rear. The turbin the air compressors, not the plane. Rotary lawn sprinklers and the nozzle at upper other examples of recoil reactions to escaping fluids.



A HYDRAULIC TURBINE IN A HYDROELECTRIC PLANT



THE SHAFT AND BL TURBINE WHEELS powerful steam turbin exposed when the co removed so that a have the disadvantage of being unable to start up readily under a full load, but may be heavily overloaded, if necessary, once they are running.

Steam is piped to the turbine from a boiler (heated by coal, oil, or gas) and is directed toward the rotor blades by the nozzles. A nozzle ring may consist of a ring of guide vanes attached to the casing. In an impulse turbine the steam expands only in the nozzles or guide-vane passages; in the reaction turbine the expansion continues as the steam passes between the specially shaped blades.

Modern steam turbines may have as many as twenty or more stages through which the steam passes in succession. Each stage consists of a nozzle ring and a ring of rotor blades. Each row of blades has a larger diameter than the preceding one to accommodate the expanding steam, and each row transforms part of the energy of the steam into mechanical energy of rotation of blades and shaft. Rotor diameters vary from a few inches to ten feet or so. The larger turbines require several casings on the same or different shafts to handle the various stages of steam pressure and velocity, and combinations of impulse and reaction blading may be used. Shafts are coupled directly only to machines that can rotate at high speeds, such as electric generators in central power stations that are designed for speeds of 1,200 to 3,600 rpm and some pumps for liquids that have speeds greater than 10,000 rpm.

Turbine shafts are coupled through reduction gears to low-speed rotary devices. Ship propellers may be so connected, or they may be driven by electric motors powered by turbine-driven generators. In locomotives driven by steam turbines the power may likewise be applied to the drive wheels through reduction gears or by electric drives.

Mercury-Vapor Cycle. One of the fundamental principles of thermodynamics is that a heat engine that operates over a wide range of temperature has a greater thermal efficiency than one that operates over a narrow range. In several large power stations the amount of electrical energy obtained from a given amount of fuel has been increased by increasing the temperature range over which the turbines operate. This is accomplished by adding a mercury-vapor cycle to the steam cycle. Liquid mercury is vaporized in a special boiler at much higher temperatures (around 900°F.) than water can be vaporized and is then passed through a turbine, which it drives. The vapor then passes to a condenser where it is cooled and condensed (liquefied) by water flowing through the condenser tubes. Heat energy given up by the mercury vapor in changing to liquid turns the water in the coils to steam for driving a steam turbine. The fact that the mercury condenser acts also as a water boiler is an additional advantage of this arrangement. The mercury cycle is completed when the heavy liquid mercury passes from the condenser to the boiler again.

Gas Turbines are similar to reaction steam turbines except that they are driven by hot gases. The complete engine consists of a rotating air compressor, a combustion chamber in which the hot gases are produced by burning fuel with the compressed air, and one or more rotors. The power output for a given fuel consumption will be considerably increased when metals are developed for combustion chambers and turbine blades that can stand higher temperatures than those that can be used at present.

A gas-turbine locomotive, like a diesel, accelerates rapidly and does not need to make stops for water as a steam engine must. It is more compact than a diesel of the same power, uses a lower grade of oil, has a lower initial cost, and a lower maintenance cost. Although the efficiency is lower, it can be raised. Coal can be used for fuel in some gas-turbine locomotives, and natural gas is the fuel for gas-turbine engines used for gas-pipeline pumping. Gas turbines are in use for emergency and peak-load service in stationary power plants where their compactness, easy and rapid starting, and ease of operation are valuable. Gas turbines are used in aircraft in two ways: a turboprop engine drives a propeller as well as the air compressor; a turbojet engine drives the compressor, but not the plane. The propulsive force on the plane is the reaction of the plane to the jet of exhaust gases shot out from the rear. See also DIESEL ENGINE; DYNAMO; STEAM ENGINE; WATER WHEEL.

TUR′BOT, a large, edible European flatfish inhabiting the Atlantic and the Mediterranean. It is somewhat shorter and broader than most flatfish and averages about twenty pounds. The upper surface, which is studded with small, wartlike lumps, is brownish; the undersurface is white. Like many flatfish, the turbot can change its color to a certain extent to match its surroundings. The female fish lays from five to ten million eggs, which float on the ocean surface until hatched. Turbot are highly prized as food and are taken commercially in British waters and elsewhere. See also FLATFISH.

Scientific Name. *Scophthalmus maximus.*

TURGENEV, *toor gya′nyef,* IVAN SERGEEVICH (1818-1883), Russian author, was born into a wealthy family in Orel and received an excellent education. After a few years in government service, he decided to make writing his career. Much of his life was spent in Paris. *Memoirs of a Sportsman,* a series of Russian country sketches published in 1852, revealed his clear, graceful style, his unusual descriptive powers, and his skill as an objective observer. Russian liberals hailed his sympathetic but realistic pictures of the Russian peasant. In 1856 Turgenev published *Rudin,* the first of his great novels, which was followed by *A House of Gentlefolk, On the Eve, Fathers and Sons, Smoke, Spring Freshets, Virgin Soil,* and other works. Turgenev's interest in social and political reform is apparent in these works. Most critics agree that *Fathers and Sons* (1862) is his finest achievement. In Turgenev's day many people attacked what they considered the dangerous views expressed by Bazarov, the hero of the novel, but with the passing of time Bazarov has come to be recognized as one of the most powerful personalities in modern fiction.

TU'RIN, ITALY (Italian *Torino*), capital of the province of Torino in the Italian Piedmont, is a busy commercial and manufacturing city in the northwest corner of the country, below the highest ranges of the Alps. It lies near the western end of the Lombardy plain, at the head of navigation of the Po River. Since main lines connect the city with Genoa and Milan and also with France and western Europe via the Mont Cenis Tunnel, Turin is an important railway junction. Rayon, cotton, and silk textiles, automobiles, railroad cars and engines, electrical machinery, and furniture are the chief manufactures. There are a number of medieval palaces and churches in the city, but Turin is concerned more with the present than the past. The University of Turin, founded in 1405, has about 10,000 students. Turin was settled in pre-Roman days and was later a Roman colony. It was associated for centuries with the house of Savoy, and when the dukes of Savoy became rulers of the Kingdom of Sardinia in 1720, Turin was made the capital of the kingdom. It served as the capital of Italy from 1860 to 1865. The population is about 730,000. See also ITALY; PIEDMONT.

TURKESTAN. See TURKISTAN.

TURKEY, a republic occupying the western projection of Asia known as Asia Minor and extending across the Sea of Marmora into southern Europe. The modern republic of Turkey, created in 1923, is all that remains of the fabulous Ottoman Empire which once threatened to engulf the Christian world. Under republican rule, modern Turkey has led all the countries of the Middle East in social, economic, and political reforms. Turkey's geographical position has the greatest commercial and military importance. Lying between southeastern Europe and southwestern Asia, it dominates the narrow stretch of water which joins the Black Sea with the Aegean and the Mediterranean. Because of Turkey's strategic location, the political and diplomatic affairs of the nation have long been matters of major concern among the world's great powers.

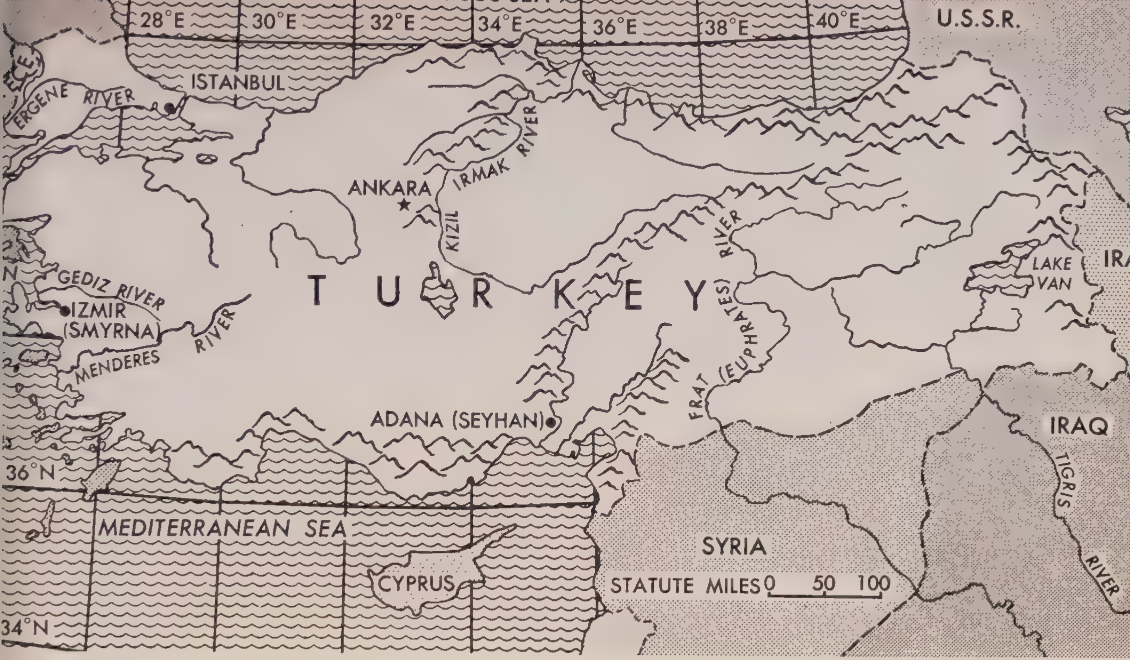
Turkey has an area of about 296,500 square miles, 10,000 square miles of which are on the European side of the waterway made up of the narrow Dardanelles, the Sea of Marmora, and the short and narrow Bosporus. The remainder of Turkey, known as Anatolia, is in Asia Minor. Turkey as a whole is bounded on the north by Bulgaria, Greece, the Black Sea, and a bit of the Russian Caucasus. The Black Sea, the Caucasus, and Iran make up the eastern boundary. To the south lie Iraq, Syria, and the Mediterranean, and to the west Greece and the Aegean Sea. European Turkey, known as Eastern Thrace, and oblong-shaped Anatolia combined are almost as large as the two American states of Texas and Indiana.

Surface Features. Both European Turkey and Anatolia have plains along their coasts, but toward the interior the land rises in hills and mountains. In Anatolia, mountains surround a great central plateau which rises to an altitude averaging about 3,300 feet. To the south are the Taurus Mountains and to the north the Şmali Anadolu Dağlari. The highest peak in Turkey is Mount Ararat (16,873 ft.) in the east, described in the Bible as the final resting place of Noah's Ark. Inland from the coast there are thick forests of pine, oak, cedar, chestnut, and beech, but few trees are found on the hills and wind-swept plains of the high plateau. In all, forests cover about one tenth of Turkey. Important rivers include the Menderes and Gediz, which flow into the Aegean Sea, and the Kizil Irmak, flowing into the Black Sea. In eastern Turkey are the upper reaches of the Tigris and the great Euphrates, which flows south to the Persian Gulf. The chief river of European Turkey is the Ergene. Of the many lakes, Lake Van, in the east, is the largest.

Climate. In general the climate is mild and the winter rainfall heavy all along Turkey's 4,450-mile coastline. Rains are very heavy along the Black Sea, and summers are hot on the southern coast. On the west coast, which escapes extremes, the winters are mild and short, the summers long and moderately warm. The plateau, behind its mountain walls, has hot, dry summers and very cold winters. Mountain snows melt and flow into the parched river beds during the wet season, but rarely does the annual rainfall exceed ten inches.

The People and Their Activities

Population. Turkey has a population of more than 19,000,000; about 85 per cent of

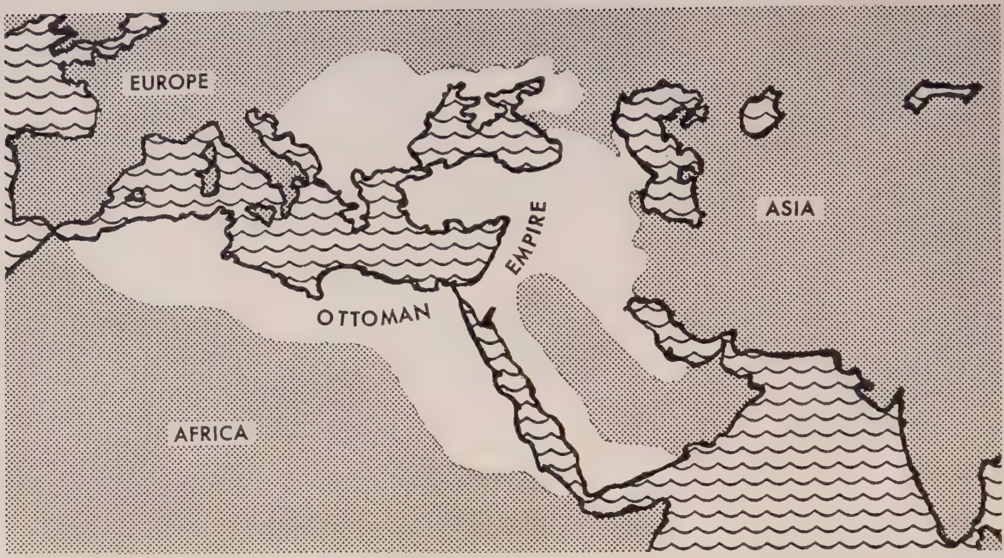


the people are descended from the Ottoman Turks. In general the Turks are a swarthy-skinned people, fairly short in stature. On the eastern plateau, living a nomadic life, are almost a million Kurds; the central plateau is thinly inhabited. In the densely populated coastal areas there is a mixture of Greeks, Bulgarians, Jews, and Armenians. The Armenian population, once very large, was almost completely wiped out by the massacres and deportations of the late nineteenth and early twentieth centuries. Although the republic grants complete religious freedom, 98 per cent of the people are Mohammedans. The largest cities include Istanbul (Constantinople), the great port on the Bosporus, with more than 850,000 inhabitants; Ankara, the inland capital; Izmir (Smyrna), the west-coast port; and Adana (Seyhan), the southern market for agricultural produce.

In republican Turkey, women, once excluded from all public life, enjoy equal rights and equal duties with Turkish men. Although Western dress has become increasingly common, the fez is still worn by some of the men and the face veil for women has not entirely disappeared. The traditional loose Turkish trousers are still seen on some members of both sexes.

Farming. Turkey, always a land of small farmholders, is becoming increasingly important agriculturally. Although only about one fourth of the land is under cultivation, more and more of it is being developed into farmlands, and the majority of the people depend on some form of agriculture for a livelihood. The coastal plains are dotted with small holdings which formerly belonged to large estates and were worked on a sharecrop basis. Through advice, demonstrations, and financial aid, government agricultural agencies are doing away with wasteful, primitive methods, and in many villages modern agricultural machinery is replacing the forked-stick plow and the ox-tread method of threshing grain.

Much of the agricultural wealth of Turkey comes from the fine tobacco raised along the Aegean and Black Sea coasts. Fragrant and of low nicotine content, Turkish tobacco is imported by the United States and other countries for blending with native varieties. Cotton, another leading export, is grown chiefly along the southern coast. Turkey still merits its ancient fame as the "Fruit Paradise of the World." Olives, peaches, apples, oranges, lemons, and other orchard fruits are widely grown, and its Smyrna figs and the raisins obtained from sultana grapes are world-famous. The entire coastal area is noted for its vegetables and fine crops of filberts, walnuts, pistachios, and other nuts. Wheat, the country's most important crop, is grown chiefly on the plains of Eastern Thrace and the Anatolian plateau, where such hardy varieties of winter wheat as *Red Turkish* originated. Barley, rye, oats, alfalfa, flax, potatoes, and sugar beets are other important crops. The Black Sea coast produces rice and tea; the Mediterranean coast, in addition to cotton, produces corn, sugar, and roses from which is distilled a volatile oil, attar of roses, used in the manufacture of fine soaps and toilet waters. Products of the Aegean coast area include raw silk, Turkey opium, a medicinal drug obtained from the white poppy, and valonia, a leather-tanning extract obtained from acorns.



THE TIDE OF MOSLEM CONQUEST and expansion swept over vast areas in three continents before the Ottoman Empire began its decline in the late 1500's.

Many of the Turkish stock raisers are nomads, who take their flocks of sheep and goats to high mountain pastures in the spring and return with them to the lower steppelands in the fall. Most of the settled stockmen raise cattle, horses, donkeys, mules, camels, and water buffaloes on the extensive pastures which villages own in common. The long, silky hair of the Angora goat, native to Turkey, provides the lustrous wool called mohair, used by sweater and blanket manufacturers throughout the world.

Mining. Turkey is rich in mineral resources, which, under the republic, are being more extensively developed as an aid to the country's new industrial program. Bituminous coal, mined in the vicinity of the Black Sea port of Zonguldak, is most abundant, with copper next in supply. The discovery of iron ore in east-central Turkey led to the launching of the first iron-and-steel industry in the Middle East. Eskişehir, in west-central Turkey, is the world's chief source of meerschaum, a white claylike mineral used in making tobacco pipes. Chrome, the most important mineral export, emery, lignite, molybdenum, lead, zinc, antimony, manganese, magnesite, asbestos, mercury, sulfur, and petroleum are among the minerals which the government has been producing in increasing quantities.

Manufacturing. The republic owes its industrial progress to the program which it has followed since starting its first five-year plan, in 1934. This program was concerned chiefly with the expansion of private enterprises and the establishment of state-operated factories. New developments included the establishment of industries based on the manufacture of chemicals and of iron and steel, and increased production of cotton and woolen textiles, paper, glass, cement, sugar, and other consumer goods. Thus republican Turkey is moving steadily toward its goal of economic independence.

Turkey is particularly noted for its food industries, which include sugar refining, flour milling, candy manufacturing, the processing of olive oil, the canning of fruits and vegetables, and the distilling of liqueurs. Traditional products include Anatolian rugs, furniture, jewelry, ornamental tiles, hammered copperware, embroidered linens, and silks.

Transportation. Under the republic, the once foreign-owned Turkish railroads are operated by the government, which has increased the amount of trackage from 2,300 miles to more than 4,700. It also has expanded the nation's highway system to some 26,500 miles and, with American financial and technical aid, has started a program to link all parts of the country in a transportation network. In an effort to expand Turkey's foreign trade the government has developed a merchant marine and is improving the ports along all three coasts. Istanbul has rail communication with Paris and London through the famous Simplon Orient Express and is connected with other parts of the Middle East by the Anadolu Express. The airports at Istanbul and Ankara are served by the Turkish Airways and all the major international airlines.

Government and Education

Government. The republic of Turkey is governed by a Grand National Assembly,

Turkey in Pictures

THE OLD AND THE NEW IN TURKEY

Above: A modern commercial college.

These girls are studying dressmaking for children at Ismet Pasha Institute.

Above: The Çubuk Dam, a modern hydroelectric development near Ankara, the capital. Right: Peasant girls of East Anatolia, typical of the republic's varied peoples.

which meets in Ankara, the capital. This body is chosen every four years at a general election in which all Turkish citizens over twenty-two years of age may vote. Its 487 members, or Deputies, represent mainly the Republican People's party and the Democratic party. The Deputies carry out the Assembly's lawmaking function, but the executive power is exercised directly by a President, whom they elect from their membership to serve during the period that each Assembly is in office. The President shares his duties with a Premier, who is assisted by a Cabinet of fellow Deputies heading the fourteen government departments. The judicial power is exercised in the name of the Assembly by various courts and tribunals. Each of the country's sixty-three provinces is governed by a general provincial assembly and by a governor. It is the national government, however, that has final authority over all the affairs of the nation, and not until 1946 did more than one party take part in a regular national election.

Education. In republican Turkey the schools are administered by the government rather than by the Mohammedan clergy, and most of them are for both sexes. Every boy and girl between the ages of seven and twelve must attend elementary school, and there are free secondary and vocational schools for those who show special ability. Institutions of higher learning include the state universities at Istanbul and Ankara, the Istanbul Technical University, and the Istanbul American College. Notable professional schools are the Ankara School of Political Science, the Istanbul Institute of Education, the State Conservatory of Music and School of Dramatic Art in Ankara, and the Istanbul Academy of Fine Arts. Adult education is aided through folk schools in the villages and community centers in the towns. Through its program of universal education, the republic by 1950 had reduced the illiteracy rate from 90 per cent to 50 per cent. Wider education has been furthered by doing away with the old Arabic alphabet and substituting the simpler Latin alphabet.

History

The Ottoman Empire. Although the history of Asia Minor goes back to the dawn of civilization, the nation called Turkey did not come into being until the early thirteenth century, when Turkish tribesmen began to pour into the peninsula from Asiatic regions to the east of the Caspian Sea. Overcoming the Seljuks, another Turkish tribe that by the eleventh century had conquered western Asia, these tribesmen established a small state which, under Othman, or Osman, became the core of the great Ottoman Empire. This Moslem empire began its expansion into Europe in the mid-fourteenth century, when Murad I crossed the Straits to Eastern Thrace and made Adrianople (now Edirne) the seat of government. In 1453, when the capture of Constantinople (modern Istanbul) by Mohammed II brought an end to the Byzantine Empire, that city became the Ottoman capital.

The Ottoman Empire reached its height under Suleiman the Magnificent, who, after coming to the throne in 1520, extended his territories as far east as Mesopotamia and as far west as Algeria and Hungary. After his death the mighty empire began to show signs of weakness. In 1571 the Ottoman navy was defeated off Greece by the Holy League fleets of Venice and Spain in the Battle of Lepanto. During the next century the power of the Turks continued to decline, and in 1683, when the Polish king, John III Sobieski, defeated their attempt to take Vienna, the Turks' hopes of further conquest of the Christian nations of Europe were ended.

The Ottoman Empire shrank slowly but steadily after 1699, at the end of the long war in which it lost Hungary to Austria and Poland regained Podolia. Russia became a threat to the weakened empire when it acquired the Crimea in 1774 and Georgia in 1783. The Serbs, in revolt after 1804, won self-government in 1829, and in the same year the rebellious Greeks finally achieved their independence.

A Puppet Power. The once mighty empire was now known as the "Sick Man of Europe." As its power waned, the sultans became increasingly lax and corrupt, entrusting most of the government to their grand viziers and court favorites. The aristocracy lived in great luxury, while the Turkish masses and the subject peoples lived in poverty and ignorance and suffered cruel oppression. Although the western European nations looked with disfavor on the Turkish Government, they feared the growing strength of Russia, and in the Crimean War (1853-56), Great Britain and France went to the aid of the tottering empire.

The Congress of Berlin, which the Western and Central European powers held after Russia had won the Russo-Turkish War of 1877-78, limited Russia's gains to northern Armenia. The Congress also recognized the independence of Serbia, Montenegro, and Rumania and placed Bosnia and Herzegovina under the control of Austria. The last of the Balkans to be freed from Turkish control were Bulgaria, in 1908, and Albania, during the First Balkan War (1912-13). The decline of the Ottoman Empire in Africa began in 1830, when France took Algeria. In 1881 Tunisia became a French protectorate, and in 1882 Great Britain occupied

Egypt. As a result of the Italo-Turkish War (1911-12), Tripoli was ceded to Italy, and at the outbreak of World War I, Great Britain took over the Turkish island of Cyprus.

In 1908-9 the weak, corrupt Turkish Government was severely shaken when the Young Turks, a group of liberal nationalists, dethroned the sultan and attempted to institute government reforms. They also hoped to recapture the vast Ottoman domain, and in 1914, Turkey entered World War I on the side of Germany. Although the Turks were able to hold the Straits in the Gallipoli campaign, their possessions in other parts of the Middle East were occupied by the Allies and, with the exception of some of the countries of the Arabian Peninsula, were later mandated to Great Britain and France. At the close of the war the Allies planned to divide Turkey among France, Italy, and Greece. These plans were never carried out, for after the landing of Greek troops at Smyrna (now Izmir) in 1919 the Turks, led by Mustafa Kemal Atatürk, fought a three-year war to free their country from foreign aggression. In 1923 the Treaty of Lausanne was negotiated with the Allies. The Straits were placed under international control, but Turkey was allowed to retain practically the territory it now occupies.

The Turkish Republic. The Ottoman era came to an end in 1922, when the revolutionary government deposed Mohammed VI and abolished the sultanate. On October 29, 1923, Turkey was proclaimed a republic, with Kemal Atatürk as its first President. The adoption of a constitution in 1924 was followed by the abolition of the caliphate (see CALIPH) and of Islam as the state religion. Other religious reforms included the separation of Church and State and the suppression of Mohammedan orders like the dancing dervishes. The Turks gave up the titles they had held under the empire and took new surnames. Turkish women achieved equality through the abolition of the harem and the ending of the purdah, which had compelled them to remain behind latticed partitions in mosques and other public places.

The Balkan League, founded in 1934, was the first of several friendship pacts which Turkey arranged with its neighbors of the Balkan Peninsula and the Middle East. In 1936 the Montreux Conference gave Turkey the right to control and fortify the Straits. During World War II the United States aided Turkey with lend-lease materials, for which it was the first nation to make full repayment. Turkey entered the conflict during the closing months, and thus was able to become a charter member of the United Nations. After 1948 it shared in the benefits of the European Recovery Program, and the Western world looked to Turkey as an important bulwark against Russian Communism. Ismet Inönü, who became President on Kemal Atatürk's death in 1938, was succeeded in 1950 by Mahmut Celal Bayar. Turkish troops showed remarkable courage in the United Nations action against Communist aggression in Korea, and in 1951 Turkey became a member of the North Atlantic Treaty Organization.

U.S.D.A.

THE ECONOMY-SIZE TURKEY (right), bred to suit the needs of small families, is contrasted with the much larger Bronze variety (left).

Related Articles. For additional information, consult the following titles:

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Armenia
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Dervish
Fez
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Harem
Istanbul
Kemal Atatürk
Kurdistan
Marmora, Sea of
Russo-Turkish War
Seljuks
Smyrna
Suleiman I
Sultan
World War (I, II)

TURKEY, a large, handsome American game bird that formerly inhabited wooded areas from southern Canada to central Mexico, from the Atlantic coast to the Rockies. Under rigid restrictions turkeys are still hunted in some of the Southern states and in Arizona and New Mexico, but elsewhere in the United States they are protected. The domesticated turkey originated in Mexico, where it was domesticated by the Aztecs. In the United States the turkey is particularly associated with Thanksgiving, but it is eaten throughout the year, and the turkey industry is a large one, with an average production of more than thirty million birds yearly. California, Texas, and Minnesota lead in turkey production. Turkey eggs are cream-colored and brown-spotted. The hens lay about fifteen to a clutch, in spring; and if the first clutch is removed they often lay a second. The eggs hatch in twenty-eight days. Turkeys grow rapidly, reaching market weights of about sixteen pounds in about six months. A smaller, quicker-maturing breed of turkeys has been developed to meet the modern demand for smaller turkeys.

TURKISTAN′, or **TURKESTAN′**, a large region of Middle Asia, extending from the Caspian Sea eastward to the Chinese province of Sinkiang. To the south are the frontiers of Iran and Afghanistan. Turkistan includes the Soviet Republics of Turkmenistan, Uzbekistan, Tadzhikistan, Kirghizia, and most of Kazakhstan. The western part of Sinkiang has been known as Chinese Turkistan. The name Turkistan reflects the belief that this was the ancient homeland of the Turks, and most of the languages spoken in the area belong to the Turkic language family. A large number of the people are Mohammedans of the Sunnite sect.

Turkistan is a wide expanse of semiarid lowlands and deserts, fringed with high mountain ranges on the south and east. The climate is continental, with hot summers, cold winters, and little rainfall. The people live on the mountain slopes and plateaus, in the river valleys, and in the oases of the south, wherever the land can be made fruitful by irrigation. Fruits, vegetables, rice, cotton, and grains are grown on these irrigated lands. The Fergana Valley in Uzbekistan is one of the richest agricultural districts in the Soviet Union. On the grassy uplands and on the mountain plateaus, cattle, sheep, camels, horses, and goats are pastured. Many of the tribesmen are nomadic herdsman. The mineral wealth of Turkistan is being exploited, and there has been a considerable development of industry. Many dams have been built on the rivers and mountain streams, in order to produce hydroelectric power and to conserve water for irrigation purposes.

The caravan routes from China to the Mediterranean, established in prehistoric times, cross through Sinkiang into Turkistan, following the line of southern oases toward the Caspian Sea. Samarkand, Tashkent, Bokhara, and Merv (Mari) are ancient trading centers on the overland route between the East and the West. The conquerors and their armies usually followed the same route. Alexander the Great marched to Samarkand in 329 B.C., and the region knew Persian, Arab, and Mongol invaders. Samarkand was the capital of Tamerlane's empire. China and Russia contended for influence in Turkistan over a long period, and in the late nineteenth century Russia acquired control of a large part of the area. One section of the country was organized as the Governor-Generalship of Turkistan. After the establishment of the Soviet Union, the whole region was divided into autonomous districts, and in the 1920's and 1930's new boundaries were set to match the ethnic groupings of the people. These new republics were eventually made constituent republics of the U.S.S.R. Uzbekistan and Turkmenistan were admitted in 1925; Tadzhikistan in 1929; and Kazakhstan and Kirghizia in 1936. See also RUSSIA, *Republics of the Union*. SAMARKAND; TASHKENT.

TURKMEN SOVIET SOCIALIST REPUBLIC. See RUSSIA.

TURKS, specifically, the inhabitants of Turkey. The name is also given to many Turkish-speaking peoples of Europe and Asia. The Turks were originally horsemen and herders on the plains of Central Asia, and they were divided into many tribes. The Huns, a Turkish-speaking tribe from this region, overran Europe in the fourth century, and they were followed by other related peoples, some of them partly Mongoloid. These were sometimes called Tatars or Tartars. In the tenth century the Seljuk tribe of Turks, converted to Mohammedanism, moved to the west from Turkistan, settled around Baghdad, and dominated the region until they were overthrown by a related people, the Osmanli, or Ottoman, Turks (see TURKEY, *History*). Racially, some of the Turkish-speaking peoples, such as the Turkomans, the Bulgars, and the modern Turks, are Caucasoid. The Tatars of Russia and the Turkish tribes of Central Asia, such as the Kirghiz, are partly Mongoloid.

TURMERIC, *tur′mur ik,* an East Indian herb of the ginger family, whose resinous aromatic rootstock, also called turmeric, is used as a yellow dye and as a condiment. The broad, pointed leaves of the plant grow directly from the rootstock, and they are centered by a stout stalk topped by a cylindrical cluster of pale-yellow flowers. Turmeric is cultivated chiefly in India, where it is used as an ingredient in curries.

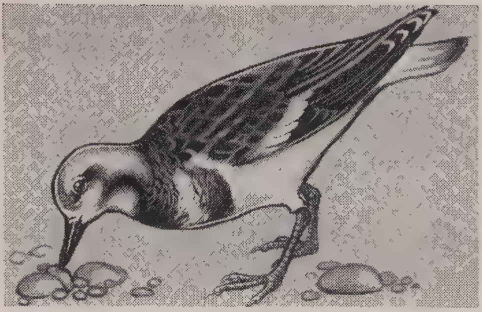
TURNER, JOSEPH MALLORD WILLIAM (1775-1851), English landscape painter, was born into a poor family in London. He studied at the Royal Academy, where he later taught perspective. His early drawings and etchings reveal remarkable draftsmanship. Turner was a strange, solitary man, absorbed in endless experiments. His style and technique changed constantly. Early in his career he was influenced by the work of the French painter Claude Lorrain, but visits to Italy greatly affected his style. From objective realism he gradually turned to subjective and romantic impressionism, experimenting with various methods of painting misty scenes full of light and color. Some of his paintings catch the glow and shimmer of sunlight in an almost miraculous manner. His startling color effects alone make him one of the most impressive landscape painters. Turner's most famous paintings are in the National Gallery and the Tate Gallery, London. A color reproduction of Turner's "Calais Pier" may be found in the article PAINTING.

TURNER, NAT (1800-1831), an American Negro slave who started the Southampton Insurrection, was born in Southampton County, Virginia. Fanatically religious, Turner claimed to have been appointed by God to deliver the Negroes from slavery, and he interpreted an eclipse of the sun in February, 1831, as a sign that the time had come. On August 21, with a small group of slaves, Turner began a day of terror by murdering all the members of his master's family. Before the day was over, about sixty slaves had joined Turner's band and more than fifty white people had been massacred. Most of the Negroes were captured or scattered the next day, but Turner escaped into the woods and was not taken for two months. He was tried and hanged with a number of his followers. The Southampton Insurrection caused great bitterness in the South. Abolitionists were blamed for the massacre, and because of it the slave laws were made much more severe.

TURNIP, a biennial herb that is cultivated as an annual for its edible roots and leaves. The roots, commonly two to four inches wide, may be top-shaped, spindle-shaped, or globular. Both white- and yellow-fleshed varieties are grown. Turnips contain about 140 calories to the pound. The tops are a rich source of vitamins A and C and the B vitamins and are high in calcium and iron.

TURNSTONE, RUDDY, a shore bird belonging to the plover family. In its spring plumage the ruddy turnstone is brilliantly colored. The back is reddish brown, marked with black and white, the under parts are white, and the breast and cheeks are marked with black in a striking pattern. In the fall the upper plumage is mostly brownish and the black pattern disappears. The ruddy turnstone breeds in the Arctic and spends the winter in many parts of the United States and in South America. It feeds on insects, grubs, and sea creatures that it finds on the beach, pushing stones over with its heavy bill as it searches for food. See also PLOVER.

Scientific Name. Ruddy turnstone, *Arenaria interpres morinella.*



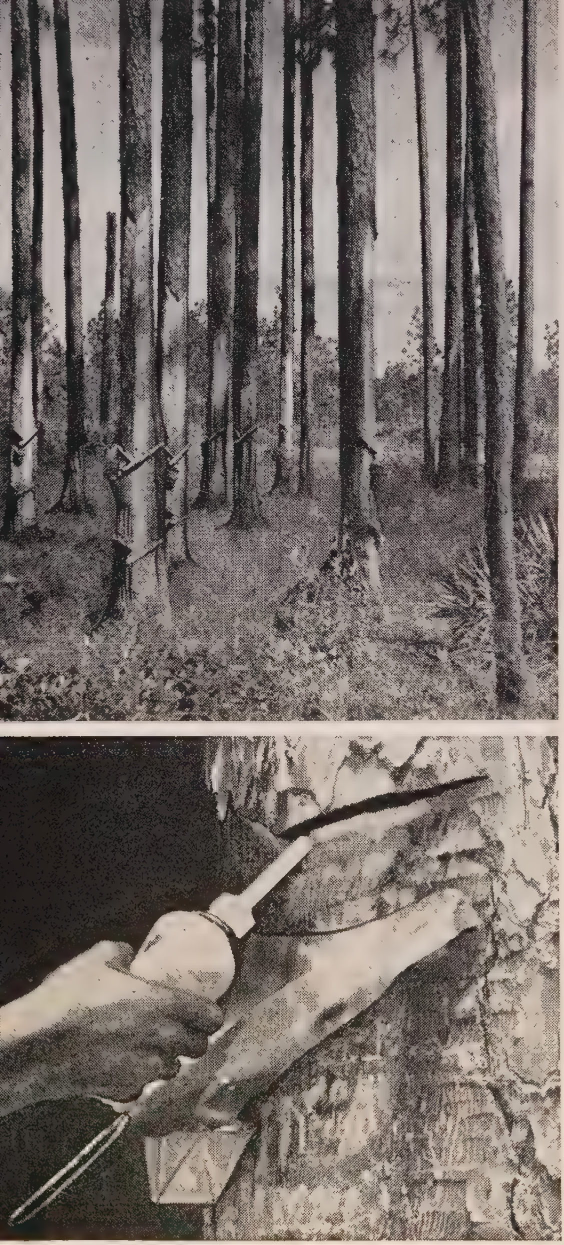
A BUSY BIRD OF THE SEASHORE, the turnstone gets its name from its method of seeking food.

TURPENTINE, an oleoresin (oily resin) obtained from pine trees; also the common name of oil of turpentine, which is obtained by distilling crude turpentine. Oil of turpentine is used as a thinner in paints and varnishes, as a solvent for oils and resins, and as a component of shoe and furniture polishes, insecticides, liniments, and medicines for the treatment of bronchial ailments. Turpentine is used also in making synthetic camphor and certain plastics. Rosin is obtained as a by-product in the distillation of crude turpentine (see ROSIN). Tar and pitch are made from the crude gum (see TAR). In the days of wooden ships, pitch and tar, used in calking the seams, were the most important turpentine products, and they are still known as "naval stores."

Production. The United States formerly produced about one half of the world's turpentine, but because of the migration of turpentine workers to better-paying industries, production declined after World War II. France ranks next to the United States in turpentine production. More than 90 per cent of the turpentine produced in the United States comes from longleaf and slash pines in Georgia and Florida. The rest is produced in other Southern states. About half of it comes from living trees, and the other half is obtained by the distillation of pine stumps, fallen wood, and, to a minor extent, by condensing, refining, and distilling the vapors produced by sulfate pulp digesters (see DISTILLATION).

Turpentine is obtained from living trees by making a series of closely spaced cuts on the trunks of the trees with a chipping tool, or "hack," and the gum that oozes from the "face" thus made is collected in tin pans. The trees are chipped weekly or biweekly from early spring until late fall. The average tree, ten or eleven inches in diameter, yields eight or nine pounds of gum yearly.

The face was formerly made about man-high and from half an inch to one inch deep in the wood. This practice shortened the life of the trees and spoiled some of the wood



U.S.D.A., Forest Service, Georgia Agricultural Extension Service

IN THE OLD METHOD (above) of collecting gum for turpentine, the trunk of the pine tree was chipped to a damaging extent. In the new method (below) sulfuric acid is sprayed into a much smaller chipped area, and just as much gum is obtained.

at their butts. The discovery that sulfuric acid stimulates and prolongs the flow of gum has made it possible to obtain the former quantity of gum merely by chipping through the bark and by making the faces only half their former height. Each face normally serves for about five or six seasons, and then a new face is cut.

Until the 1930's the gum was distilled in small, privately owned, copper pot stills. Nowadays almost all gum is taken to centralized distillation plants, which have been established throughout the turpentine region. Turpentine will seep through common wooden barrels. Hence it is stored either in tinned metal containers or in white-oak barrels which have been coated with glue on the inside.

TURQUOISE, *tur'koiz,* a semiprecious stone of a beautiful blue, blue-green, or green color. Cut and polished, it has long been a favorite gem in the Middle East. The turquoise of Iran has been famous for centuries. Americans are most familiar with turquoise jewelry made by Indian craftsmen of the Southwest, where the stone is fairly plentiful. Turquoise is easily damaged, and the coloring can be spoiled by contact with many common acids. A magical stone to many ancient peoples, it is described by chemists as a hydrous phosphate of aluminum containing some copper. *Bone* turquoise, or *odontolite,* is not true turquoise but is composed of fossil bone.

TURTLE, a common reptile with a hard, protective shell covering the soft parts of its body. Over two hundred species of turtles are distributed over the temperate and tropical regions of the world. Some inhabit fresh or salt water, others live strictly on land, and a few spend their time partly on land and partly in water.

Structure and Habits. Turtles have survived since prehistoric times without any drastic changes in their physical structure. The shell, which consists of bone covered with horny plates, is formed by a domed or flat upper shell, called the *carapace,* and a flat under shell, or *plastron.* A bony bridge joins the two parts on the sides, leaving openings through which the head, legs, and tail protrude. The curved shell provides excellent protection, though it often prevents an upside-down turtle from righting itself. In time of danger many turtles can pull in their head and legs, and some have hinged shells which enable them to "close up shop" completely. A few seem to have outgrown their shells and must run, swim away, or fight for their lives when attacked. Although turtles are toothless, some species are savage battlers with jaws of iron.

Depending on their size and where they live, turtles feed on vegetation, insects, worms, lizards, frogs, fish, or small mammals. They can go for long periods without eating; certain species fast during hibernation (the winter sleeping period). All turtles breathe by means of lungs; the aquatic species can remain under water without breathing for several hours at a time. Female turtles lay from one to more than one thousand white eggs in shallow holes, which they scoop out of the sand or dirt with their hind legs. After the eggs have been buried, they are left to hatch in the heat of the sun. Many turtle eggs and young turtles are devoured by various kinds of animals, but turtles that escape an early death usually live long lives, some reaching over a hundred years.

Kinds of Turtles. It is difficult to distinguish between turtles, tortoises, and terrapins. In general, the name turtle is given to salt-water species, which have flippers rather than feet; the tortoises are the land dwellers, with blunt, rounded feet; and the terrapins are fresh-water species, which have webbed feet with clawed toes. According to some authorities, only the edible fresh-water species should be called terrapins.

Most sea turtles are slow and clumsy on land but surprisingly graceful in the water. Examples are the *green* turtle, which is often made into turtle soup, and the *hawksbill* turtle, which is the source of tortoise shell (see TORTOISE SHELL). Another species that is commonly eaten is the *diamondback* terrapin, which is found in salt marshes in the eastern United States and is raised commercially on terrapin "farms." Other American turtles are also eaten, including the vicious *snapping* turtle. Turtle soup is a popular delicacy.

Outstanding among land turtles are the *giant* tortoises of the Galápagos Islands that sometimes reach a weight of five hundred pounds. In the United States are found the *gopher* tortoise, which burrows under ground, and the *box* turtle, which can seal itself tightly within its hinged shell. Like most land turtles, they do not travel far from their immediate surroundings. Among the interesting fresh-water species are the evil-smelling *musk* turtle of southeastern Canada and the eastern United States and the common *mud* turtle found from Long Island southward.

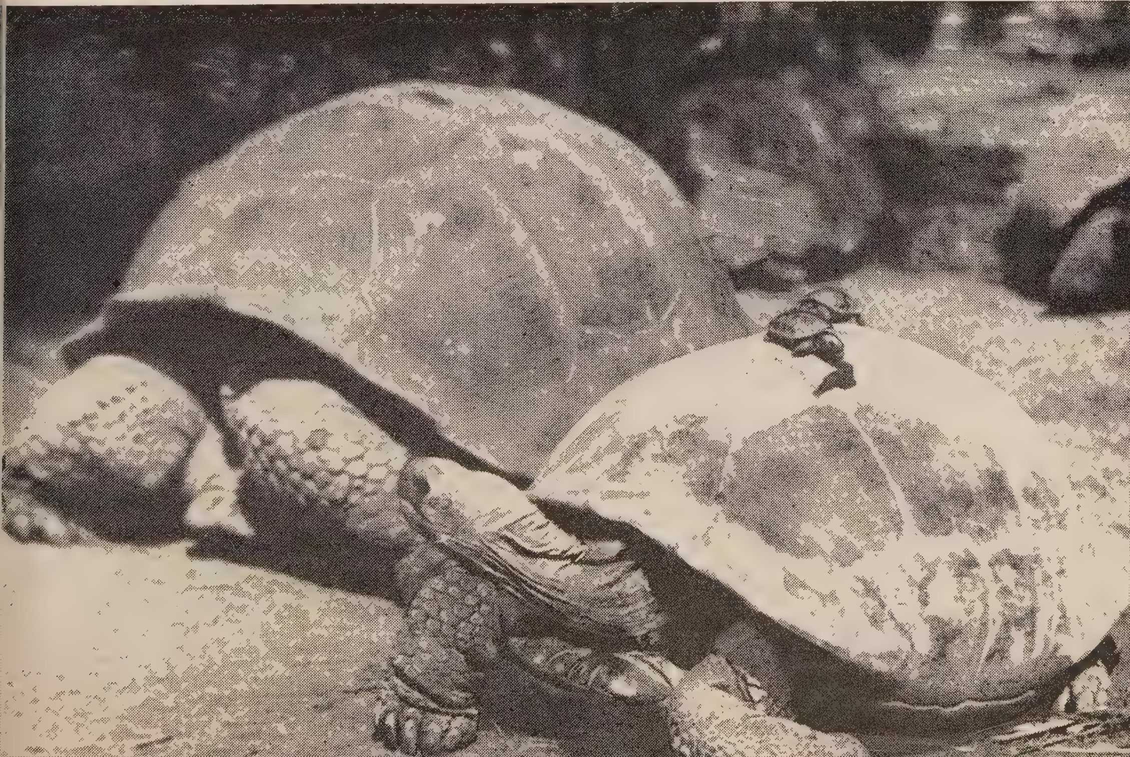
A few turtles lack the characteristic hard shell. Among these are the marine *leatherback,* which sometimes weighs over a thousand pounds and is encased in a tough, leathery skin, and the fresh-water *soft-shelled* turtles, which have a long neck and elongated snout. Other species, the side-necked turtles, have necks so long they must be folded sideways and cannot be pulled back under the shell.

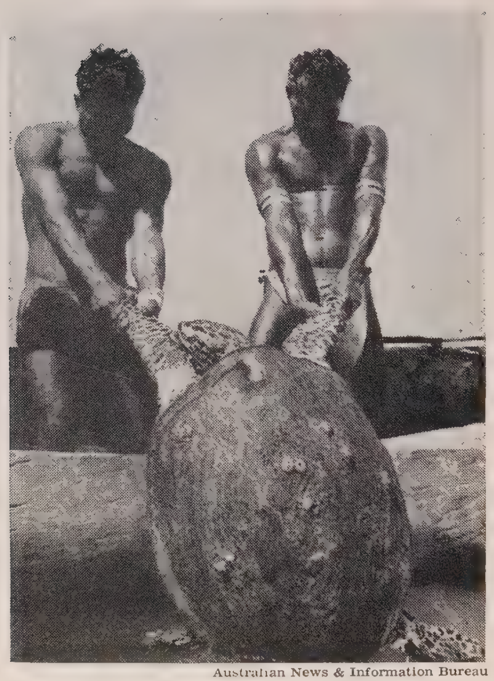
Turtles make interesting and amusing pets. Among the species often kept in captivity are *painted, spotted, wood, box,* and *Troost's* turtles. The perfect pet turtle is one that neither snaps hungrily at a moving finger nor spends most of its time hidden within its shell. Captive turtles can be fed chopped raw meat, earthworms, meal worms, fish, and lettuce. The turtle's shell should never be carved or covered with paint because these cruel practices may kill the animal. See also BOX TURTLE; HAWKSBILL TURTLE; LEATHERBACK; SNAPPING TURTLE; TERRAPIN; TORTOISE.

Scientific Names. Musk turtle, *Sternotherus*

THE TINY BABIES of a Galapagos tortoise go for a ride aboard their huge mother's back.

Bermuda News Bureau





Australian News & Information Bureau

A GIANT SEA TURTLE is hauled into a primitive canoe by Australian aborigines.

odoratus; mud turtle, *Kinosternon subrubrum;* southern soft-shelled turtle, *Trionyx ferox;* painted turtle, *Chrysemys marginata;* spotted turtle, *Clemmys guttata;* wood turtle, *C. insculpta;* box turtle, *Terrapene carolina;* Troost's turtle, *Pseudemys troostii.*

American Museum of Natural History, New York

THE ENORMOUS LEATHERBACK TURTLE may weigh as much as a full-grown dairy cow.

TURTLEDOVE, any of several species of European pigeons. The turtledoves are usually grayish brown, with purple tinges on the breast feathers. Their soft, cooing note is much like that of the North American mourning dove. Their flight is strong and rapid, and they feed on fruit, berries, and insects. At breeding time a pair of turtledoves build a frail platform of sticks for a nest, in which the female lays two creamy-white eggs. Two broods may be raised in a year.

Scientific Name. Common turtledove, *Turtur communis.*

TUSCANY, *tus'kuh nih,* a political division of modern Italy, lies between the Apennine Mountains and the Tyrrhenian Sea in the north-central part of the country. The land, which slopes from the mountains westward toward the sea, is crossed by the Arno and several other rivers, and in the rich, fertile valleys grapes, wheat, olives, corn, and tobacco are grown. The mountains yield various metal ores and marble. Sheep graze in the hills in summer and are brought down into the valleys during the winter. Tuscany is noted for its beautiful landscapes, its fine handcrafts, and its rich heritage of art and literature. The principal cities are Florence, which is the capital, Pisa, Siena, Lucca, Pistoia, Arezzo, and Leghorn, the chief port. The Tuscan dialect was accepted as the language of Italy during the Renaissance, largely because of the influence of Dante, Boccaccio, and Petrarch.

The region was occupied in ancient times by the Etruscans, who were eventually conquered by the Romans. Some centuries after the fall of Rome, Tuscany emerged as an independent territory. It was later broken up into small city-states, which were gradually absorbed by the growing power of Florence under the rule of the Medici. In the sixteenth century it became a grand duchy with the Medici as hereditary rulers. With the extinction of the Medici house, the duchy passed to the house of Lorraine, and except for brief periods during the Napoleonic Wars it remained in the possession of the Austrian emperors. In 1860 it was joined to the Kingdom of Sardinia, and soon became a part of united Italy. Tuscany has an area of 8,876 square miles and a population of about 3,000,000. See also FLORENCE; ITALIAN LANGUAGE; ITALY; MEDICI; PISA.

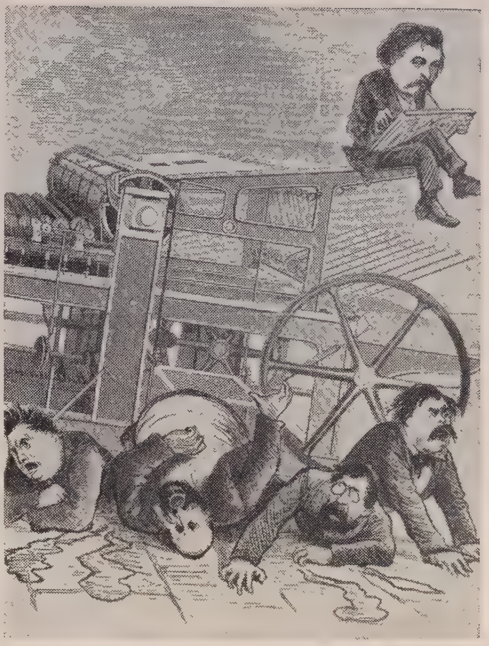
TUSCARORA, *tus kuh ro'ruh,* a migrating Iroquoian tribe, originally located in the region of North Carolina. The group finally settled in New York and was received as a sixth member in the Iroquoian Confederacy. There is still a small Tuscarora reservation near Niagara Falls. See also IROQUOIS.

TUS'SOCK MOTH, a family of moths named from the tufts of hairs, often brightly colored, appearing in the caterpillars. The moths are dull-colored, and the females of some species are wingless. Several species are very destructive to fruit, shade, and forest trees, the most notable among these being the *gypsy* moth, the *browntail* moth, and the *white-marked* tussock moth. Of the last named there may be two or three generations each summer, and the young caterpillars are extremely greedy, destroying the leaves of many trees. Trees are protected against these moths by picking and burning the cocoons, by spraying with lead arsenate, and by banding uninfested trees to prevent the spread of the caterpillars. See also BROWNTAIL MOTH; GYPSY MOTH.

TUTANKHAMEN, *toot ahngk ah'men* (about 1368-1350 B.C.), the son-in-law of the Pharaoh Ikhnaton, succeeded to the throne of Egypt when he was a boy of twelve. He died about six years later after an uneventful reign and was buried in the Valley of the Kings, near ancient Thebes. His name is familiar to many people because an archaeological expedition under the direction of Howard Carter uncovered the royal tomb in 1922 and found it full of magnificent treasures. Although robbers had evidently invaded it soon after Tutankhamen's death, they had been stopped before they could pillage the tomb. The mummy of the boy king, encased in three coffins, one of which was solid gold, was found intact in an inner shrine. It was surrounded by priceless objects of art in gold and precious stones, and other chambers of the tomb contained a wealth of household furnishings, vases, statues, weapons, and even chariots. Most of these ancient treasures are now in the Cairo Museum. See also ARCHAEOLOGY.

TWAIN, MARK. See CLEMENS, SAMUEL LANGHORNE.

TWEED, originally an all-wool Scottish homespun from the region of the Tweed River. Modern tweed is a rough, usually unfinished fabric made in a plain, twilled, or herringbone weave, of wool dyed in the fiber. Two-ply yarn, in two or more colors, may be used in the warp alone or in both warp and filling. Scottish tweeds known as heather mixtures combine many colors. Tweed is woven in a wide range of weights, from fine to heavy. It is used for dresses, suits, and coats. *Harris* tweeds are made by hand in the Outer Hebrides, off the west coast of Scotland. The yarn is dyed in kettles heated over peat fires, and the tweeds often smell of peat smoke, especially when damp. See also TEXTILES.


Brown Brothers

THE MEANING OF THIS CARTOON of the Tweed era is that newspaper and magazine publicity (represented by the printing press and the little cartoonist) helped to break the power of "Boss" Tweed (second from left) and his friends.

TWEED, WILLIAM MARCY (1823-1878), American political boss, organized and headed a group of New York politicians that came to be known as the Tweed Ring. Tweed was elected alderman in New York City in 1852. From 1853 to 1855 he served in the United States House of Representatives, but his chief interest was in New York City politics. He gained power in Tammany Hall, the Democratic organization in the city, and with a circle of corrupt associates proceeded to plunder the city treasury. The Tweed Ring may have taken from $30,000,000 to $200,000,000 by all kinds of frauds. Its members bribed judges, police, and other officials from the highest level to the lowest. About 1870 the New York *Times* and *Harper's Weekly* began to publish the truth about Tweed. Thomas Nast's powerful cartoons in *Harper's Weekly* helped to break up the Ring and bring its leader to trial. Tweed was convicted and sent to jail for a year. After his release he was sued by the state of New York for recovery of stolen funds. He fled the country but was arrested in Spain and brought back to New York. He died there in a city jail.

TWEED RIVER, a river about ninety-five miles long, in southeastern Scotland. It rises in the Uplands near the source of the Clyde and flows to the east and northeast, emptying into the North Sea at Berwick. The lower reaches of the Tweed form the eastern end of the boundary between England and Scotland. The river, which is famous for salmon fishing, passes through lovely rolling country. Abbotsford, the home of Sir Walter Scott, Dryburgh Abbey, and Melrose Abbey are in the valley of the Tweed.

TWEEDSMUIR, JOHN BUCHAN, BARON. See BUCHAN, JOHN.

TWELFTH NIGHT. See EPIPHANY.

TWELVE TABLES, LAW OF THE, the earliest written code of law among the Romans. According to tradition it was drawn up to appease the plebeians, who complained that,

American Dairy Goat News, Richmond, Va.

LOOK-ALIKES GET TOGETHER, when Mother Goat shows her twin kids to a pair of smiling visitors.

because the laws had not been put into written form, the people could not tell whether they were getting just decisions from the patrician magistrates. In 451 B.C. a commission of ten men, called the *decemvirs,* was elected to draft the laws, and the following year ten tables were finished and set up in the Forum. Another group of decemvirs added two more tables to the code. The original Tables were destroyed when Rome was sacked. See also DECEMVIRS.

TWILIGHT, the period between sunset and full darkness or between darkness and the dawn. The glow that remains in the sky after the sun has disappeared is sunlight reflected and scattered by dust particles in the upper atmosphere. When the sun is 18° below the horizon, the reflected rays are no longer visible and twilight ends. The latitude of the observer and the time of the year determine the length of the twilight period. In the tropics, where the sun's apparent path is nearly perpendicular to the horizon, twilight is brief and does not vary much from season to season. In the middle northern latitudes in summer it may last more than two and one-half hours, and it increases in the higher latitudes.

TWILIGHT SLEEP. See ANESTHESIA.

TWILL, in the weaving of textiles, a basic weave in which the filling, or weft, is floated over two or more warp yarns after being passed under one or more. These floats are shifted in each successive row. If the shift is always in the same direction, a diagonal line is produced in the fabric; if the direction is changed at regular intervals, a zigzag pattern, or *herringbone* twill, results. Twills are closely woven and very strong. Gabardine, flannel, cheviot, tweed, serge, and foulard are fabrics done in a twill weave. See also TEXTILES; WEAVING.

TWINS. When two persons or animals are born of the same mother at the same time, they are called twins. Among certain animals, such as deer, sheep, and goats, twin offspring are common. On the other hand, in cattle, horses, and some of the larger wild animals twins are more or less rare. Human twins occur about once in every eighty-six births. Very often they are born prematurely or are weak at birth, and therefore the death rate for twin births is much higher than for single births. In some families the tendency to have twins seems to be a hereditary trait.

Twins may be either identical or fraternal. *Identical* twins develop from one egg which divides to produce two individuals. Since these twins have the same hereditary make-up, they are always of the same sex and usually look so much alike that it is difficult to tell them apart. Identical twins who differ in size have been affected by differences in their environment within the mother's uterus. *Fraternal* twins develop from two separate eggs which have been fertilized at the same time. They have different hereditary

Brown Brothers: Bettmann Archive

WHILE TYLER WAS PRESIDENT, he lost his first wife, Letitia Christian Tyler (left), and married his second, Julia Gardiner Tyler (right).

characteristics and therefore are no more closely related than ordinary brothers and sisters, except that they are of the same age. Sets of twins consisting of one boy and one girl are always fraternal, but twins of the same sex may also be fraternal. These twins may not even look alike. Three fourths of all twins born are of the fraternal type.

Occasionally twins are born joined together. Known as *Siamese twins,* most of them die at birth or in early infancy. Some, however, have survived to old age. Though a few have been successfully separated by surgical operation, most Siamese twins share one or more organs and therefore cannot be separated. Some authorities believe that Siamese twins result from one egg that does not divide completely. Others think that two eggs become joined together. The name Siamese twins originated with two Chinese twins, Chang and Eng, who were joined together at the waist. They were brought to the United States from Siam in the early nineteenth century by P. T. Barnum. They were billed as Siamese twins in the circus, and since then the name has been commonly given to all joined twins.

TYCHO BRAHE. See Brahe, Tycho.

TYLER, John (1790-1862), tenth President of the United States, was the first to reach that office through the constitutional provision which makes the Vice-President successor to a President who dies in office. After succeeding William Henry Harrison, who died less than a month after his inauguration, Tyler fought a hostile Congress with stubborn independence and accomplished far more than many of the better-known Chief Executives.

Early Years. Tyler was the son of Mary Armistead Tyler and John Tyler. His father was a leading Virginia patriot in Revolutionary days and later governor of the state and a Federal District judge. The son was born at "Greenway" in Charles City County. He graduated from the College of William

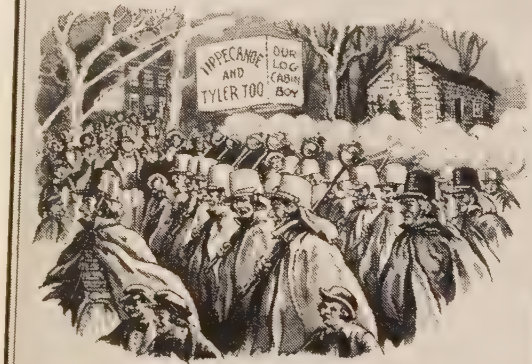
Major Events During Tyler's Administration

World Affairs		*Domestic Affairs*
"Hungry Forties" in Great Britain; business depression, unemployment, political unrest, emigration.	**1841**	Harrison dies (April 4); Tyler inaugurated. Independent-treasury law repealed. Veto of Whig program causes Cabinet resignations.
British win treaty ports in China.	**1842**	Webster-Ashburton Treaty. Higher tariff voted. Dorr's Rebellion in Rhode Island.
	1843	Tyler seeks annexation of Texas. Migration to Oregon increases.
British and French efforts to extend influence in Texas.	**1844**	Texas annexation fails in Senate. Commercial treaty with China. Slavery question splits the Methodist Church. First telegraph message transmitted.
	1845	Florida admitted. Texas annexed.

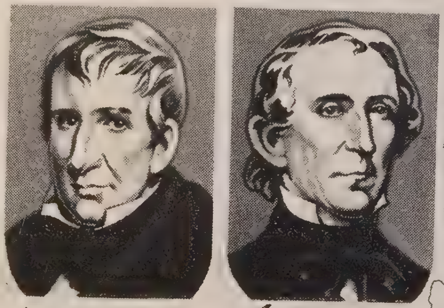
THE ADMINISTRATIONS OF
WILLIAM HENRY HARRISON AND JOHN TYLER

NINTH PRESIDENT OF THE UNITED STATES
MARCH 4 *to* APRIL 4, 1841

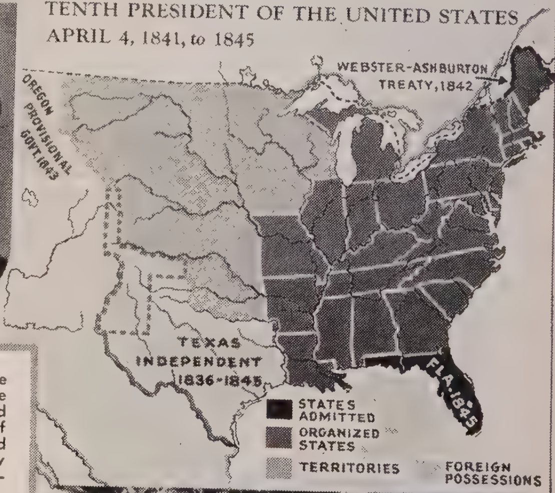
TENTH PRESIDENT OF THE UNITED STATES
APRIL 4, 1841, *to* 1845



A MIDDLE-CENTURY POLITICAL CAMPAIGN PARADE



W H Harrison John Tyler


WEBSTER-ASHBURTON TREATY, 1842
OREGON PROVISIONAL GOVT. 1843
TEXAS INDEPENDENT 1836-1845
FLA. 1845
STATES ADMITTED
ORGANIZED STATES
TERRITORIES
FOREIGN POSSESSIONS

Harrison, President for a month, signaled the triumph of the Whigs, restored to power by the Panic of 1837. Clay and Webster had designed to place him, a great figurehead, at the bow of the ship, while they directed the crew. And Tyler, succeeding to office, made ready to follow Harrison's course as respectfully as he had followed his bier.

The resolutions, an epitome of the Tyler administration and the essence of the Whig policies, were Clay-made, heralding the return of the old aristocracy. They would restore the Bank and abolish the Treasury, revise the tariff and allot to the states the proceeds from land sales within their bounds. Deftly concealed was the plan by which the Federal government should finance internal improvements within the states through the sale of land and a high protective tariff.

CARTOON: THE SOUTH WOOS, THE NORTH RESISTS, A WILLING TEXAS

WASHINGTON AND BALTIMORE JOINED BY TELEGRAPH, 1844

CLAY'S COMPROMISE ASSUAGED THE SOUTH; PLEASED THE NORTH

Boatmen's National Bank of St. Louis

THE POLITICIANS OF TYLER'S DAY did not have radio and television to reach great audiences; so they addressed small groups, as "Stump Speaking," by George Caleb Bingham, shows.

and Mary at seventeen and began to practice law in 1809. From 1811 to 1816 he served in the house of delegates, or state legislature, where his personal charm and his ability as a speaker won him friends and admirers. Tyler was elected to Congress in 1816 and remained there until ill-health forced him to resign in 1821. Like his father, he was a Jeffersonian Republican, a member of the party from which the modern Democratic party grew (see DEMOCRATIC PARTY). As such, he believed the Constitution must be followed to the letter; he therefore opposed the United States Bank, protective tariffs, and internal improvements at government expense. He was also against the Missouri Compromise (see MISSOURI COMPROMISE).

Political Conflict. His health restored, Tyler served in the state legislature in 1823 and 1824 and was governor in 1825 and 1826. The next year he was elected to the United States Senate by state assembly members opposed to Andrew Jackson and his faction of the Jeffersonian Republican party. Tyler had favored censuring the bold General for his invasion of Spanish Florida in 1814, but in 1828 and 1832 he supported him as the "least objectionable" of the available candidates (see JACKSON, ANDREW). Favoring states' rights, he opposed the "Tariff of Abominations" in 1828 and disliked the Tariff of 1832, which was "nullified" by South Carolina (see STATES' RIGHTS; NULLIFICATION). He helped to work out the Compromise Tariff of 1833, by which duties were to be gradually lowered, and denounced the Force Act, which sought to assert the authority of the national government over the rebellious states.

As anti-Jackson forces slowly grouped to form the Whig party, Tyler became leader of its Southern states'-rights wing. The unnatural alliance of this faction with the nationalists led by Clay and Webster continued under Jackson's successor, President Van Buren. In 1836 antiadministration leaders in Virginia named Tyler as candidate for Vice-President; but a year later he quit the Senate rather than vote to cancel a Congressional censure of Jackson's actions during the National Bank controversy, in accordance with the instructions of the Virginia legislature. He was elected to the Virginia house of delegates in 1838 and served as president of the state branch of the American Colonization Society, which proposed to transport Negro slaves to Africa.

Although he failed to regain his Senate seat in 1839, the next year Tyler was nominated for Vice-President by the Whigs in order to win Southern support. The ticket, with the military hero William Henry Harrison as presidential candidate, won the election in the famous "Log Cabin and Hard Cider Campaign."

Tyler's Administration, 1841-1845

Within a month Harrison was dead, and on April 4, 1841, Tyler became President. He kept Harrison's Cabinet but opposed the spoils system and refused to disturb the holders of important posts for merely political reasons. Still a believer in strict interpretation of the Constitution, he could not support the program of the Whig leader, Henry Clay. He vetoed bills re-establishing the United States Bank and rejected internal-improvement measures. Like Jackson, Tyler acted on the principle that the President, representing all the people, shares with Congress the responsibility for legislation. His vetoes drew a resolution of censure from Congress. The angry Whigs called him "His Accidency"; all his Cabinet members except Webster resigned in protest in 1841; and Clay quit the Senate in 1842.

Treaties. Tyler gave strong support to the important Webster-Ashburton Treaty (1842), which ended a controversy over the boundary between the United States and Canada in the east, smoothed over a series of international incidents arising out of the Canadian Rebellion of 1837, provided for a joint naval patrol to suppress the African slave trade, arranged for the extradition of certain fugitives, and quite possibly prevented a war with Great Britain. Also important was a treaty which granted America commercial rights in the Far East, opening five Chinese ports to trade.

National Affairs. Tyler favored the annexation of Texas, then an independent republic, and was prepared to use military force to prevent Mexico from invading its former province. However, a treaty of annexation was blocked in the Senate in June, 1844, partly by antislavery leaders. For their presidential candidate that year the Whigs chose Clay, who opposed annexation in an open letter. Polk, the Democratic candidate, boldly urged annexation and won the election. In his message to Congress in December, Tyler recommended annexation by a joint resolution of both houses. His suggestion was followed, and he had the satisfaction of signing the resolution for annexation on March 1, 1845. See TEXAS, *History*.

Frequently opposed by members of his own party, Tyler as President strengthened the tradition of executive independence which Jackson had founded. Strong, courageous, and stubborn, he was also an honest and able administrator. A contemporary describes him as "above middle height, somewhat slender, clean-shaven, with light hair" and "light blue eyes" in which a "humorous twinkle" lurked.

The Private Citizen

Tyler spent the rest of his life at his home, "Sherwood Forest," in Charles City County. He presided over the Peace Conference which met in Washington in February, 1861, in a vain attempt to prevent civil war. When the break came, he urged Virginia to secede. He was a member of the Confederate Congress when he died, on January 18, 1862. Tyler's first wife was Letitia Christian Tyler, whom he married in 1813 and who died in 1842. In 1844 he married Julia Gardiner, who survived him by many years. Seven children were born to each wife. A son, Lyon Gardiner Tyler, won distinction as a scholar and historian and served as president of the College of William and Mary.

America Under Tyler

Today we can quickly recognize the significance of a number of events of Tyler's day, though some of them probably seemed unimportant to Americans of that time. Conditions and developments in the early 1840's contributed to later scientific, industrial, and social progress and had direct bearing on the outbreak of the Mexican War and the division of the Union in the War between the States.

The West. In Tyler's day the rivers and the new canals in the region south of the Great Lakes were busy commercial thoroughfares, crowded with puffing steamboats and loaded barges. As the Middle West filled up with settlers, the traders and pioneers moved into what is now New Mexico along the Santa Fe Trail and crossed the continent by the Oregon Trail to the far-off Columbia Valley. News of the Pacific Coast was sent East by John Frémont and Kit Carson. From the Republic of Texas came word of Mexican raids and border tension. Incidents in 1842 revealed the inability of the Texans to fight back successfully, and within the United States the demand for intervention grew louder.

The South. Southerners were especially concerned about Texas, for cotton planters were already extending their holdings across Louisiana. Although the "Gag Rule," banning the discussion of antislavery petitions in Congress, was broken in 1844 and abolitionist sentiment was growing in the North, the Liberty party, which sought to end slavery in certain territories, mustered only sixty thousand votes in the election of 1844. Four years later, however, the Liberty party joined the new Free-Soil party, which helped defeat the Democratic ticket.

Industry and Science. The great majority of Americans were farmers in Tyler's day, but other fields of activity were prominent. Americans were the world's foremost whalers, and American shipbuilders were about to make their most exciting bid for maritime supremacy with the magnificent clipper ships. New England textile mills were expanding, and new methods for harnessing water power were being sought. The use of anthracite coal in the iron industry was a significant development, as was the Charles Goodyear process for vulcanizing rubber. The most important scientific event of the era was the success of the telegraph line set up in 1844 between Baltimore and Washington (see TELEGRAPH).

The American Scene. In Rhode Island, after an uprising known as Dorr's Rebellion (1842), that state became the last of the original thirteen colonies to grant suffrage to all native-born male citizens. In Massachusetts the chief justice of the state supreme court declared labor unions to be lawful, and in the same state the widespread interest in co-operative communities during this period was represented by the famous gathering of intellectuals at Brook Farm. Easterners, including Emerson, Hawthorne, Thoreau, Longfellow, Lowell, and Holmes, dominated the literary scene. Thus, while the new West was being opened up, the old East did not stagnate. History was in the making in Tyler's administration, though the differences between his age and the present period might be suggested by the fact that the great city of New York only got around to organizing a police department while President Tyler was in the White House.

TYLER, WAT or WALT (?-1381), was the leader of a revolt of the workers in England, known as Wat Tyler's Rebellion. After the Black Death, a plague that struck the country in 1348 and carried off nearly one third of the people, labor was scarce, and laws were passed to keep the workers from asking higher wages or seeking better-paid jobs. A head tax of one shilling was imposed in 1379, and the efforts to collect the tax added to the resentment of the peasants. In June, 1381, uprisings began in Kent and Essex, and Wat Tyler was chosen as their leader by several thousand rebels. Under his guidance they captured Canterbury and marched on London, where they were not opposed. The boy king, Richard II, met Tyler and agreed to allow the rebels' demands. That night the mob pillaged London and killed several officials. On June 15, when the King conferred with Tyler again, a dispute arose, and Tyler was killed. King Richard dispersed the mob, and the concessions he had granted were revoked.

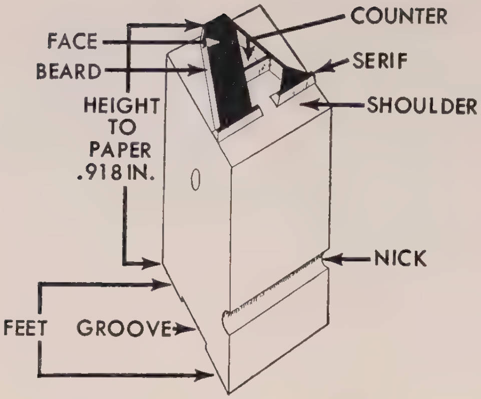
TYNDALE, *tin'd'l,* WILLIAM (about 1492-1536), a leader of the Protestant Reformation in England and a translator of the Bible, studied at Oxford and Cambridge and was ordained as a priest. He came under the influence of the Reformation and decided to translate the Bible into English, but he had to leave England to escape prosecution as a heretic. After a visit with Martin Luther, he settled at Cologne and worked there until he had to move again to avoid his enemies. His translation of the New Testament was finally printed at Worms in 1526, and copies were smuggled into England in spite of a strict ban against the book. Tyndale continued his work until he was betrayed into the hands of Emperor Charles V. After a long imprisonment he was executed as a heretic. Tyndale was a scholar with a genuine literary talent, and his inspired translations of the New Testament, the Pentateuch, and the Book of Jonah greatly influenced the men who produced the famous King James Bible of 1611.

TYNDALL, JOHN (1820-1893), distinguished physicist and author of popular scientific works, was born in county Carlow, Ireland. His formal education was limited, but he continued studying while working as a surveyor and civil engineer. Although very successful as a teacher of mathematics at Queenwood College, he insisted on leaving the post in 1848 in order to attend the University of Marburg in Germany. There he received a doctor's degree in 1851. Three years later he became a professor of physics (then called natural philosophy) at the Royal Institution in London. In 1867, upon the death of Michael Faraday, Tyndall was appointed superintendent. Later he gave a series of lectures in the United States and used his earnings to set up a trust fund for scientific research in American universities. He retired in 1887.

Tyndall's major work in physics was an intensive investigation of the transmission of radiant heat and its absorption by gases and vapors. He also studied light, sound, and electricity, the structure of glacial ice, and the magnetic properties of crystals. In his books and especially in his lectures, he was unusually successful in making physics understandable and interesting to those without special scientific training. Among his many works are *Faraday as a Discoverer* (1868), *Fragments of Science for Unscientific People* (1871), *Hours of Exercise in the Alps* (1871), *Contributions to Molecular Physics in the Domain of Radiant Heat* (1872), *Six Lectures on Light, Delivered in America* (1873), and *On Sound* (1875). At a time when science and religion seemed to be permanent foes, Tyndall's *Belfast Address* (1874) was highly effective in reconciling the different points of view and was widely discussed.

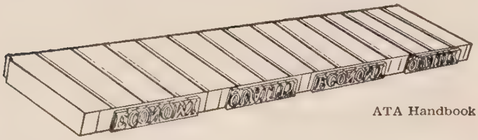
TYPE, usually a piece of metal bearing a raised letter or other character. When the key on a typewriter is struck, a type hits the typewriter ribbon, producing a character on the paper. Types were set at the beginning of the process of printing this encyclopedia. In fact every printed character turned out by the publishing industry is originally produced by a type.

Early Typemaking. Wooden letters were probably engraved by or for Johann Guten-

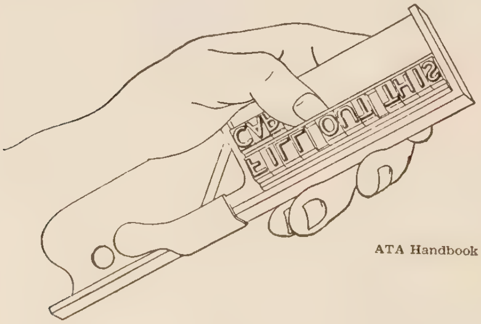


EACH TYPE used in modern printing is cast according to precise specifications.

berg, a German of the fifteenth century who is often called the inventor of printing. These were used to make molds from which metal, probably lead, types were cast. These types could be made square and uniform by hand, and printing of a sort could be done with them. But this clumsy device was simply an early step toward true typemaking. A great advance occurred after Peter Schoeffer, a skilled mechanic, joined Gutenberg. Schoeffer undoubtedly thought up the idea of engraving the pattern letters on a steel punch, which could be sunk in a softer metal to form a matrix, or mold. From the matrix it was possible to cast countless types of each letter. The first types were copies of handwritten letters, but with Schoeffer's innovations the craft of type founding was born. The changes that have occurred since his time consist more in improved mechanical devices for casting the types than in the types themselves.


ATA Handbook

A SLUG for an entire line of type is cast mechanically on the Linotype.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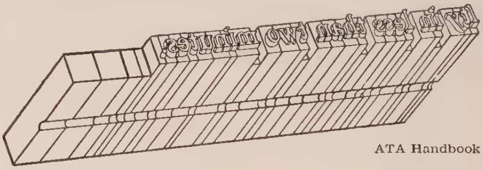
A COMPOSING STICK is used in setting foundry type by hand.

Hand Processes. Until the last quarter of the eighteenth century the pattern letters were fashioned by hand on one end of a carefully squared steel bar. When the shape of the letter satisfied the punch cutter, the punch was hardened and tempered, and the engraved face was polished.

For the matrix, or mold, a piece of copper was used. The punch was held upright in a metal frame to keep it steady, and the frame was held in a vise. The copper blank was fastened under the punch, which was then struck with a heavy hammer so as to form a sunken mold of the letter in the copper.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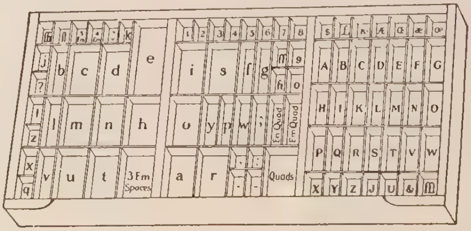
INDIVIDUAL LETTERS are cast mechanically, one at a time, on the Monotype.

Types were cast by hand in a mold consisting mainly of two carefully fitted steel parts which held the matrix opposite to the opening through which the type metal was poured. As the caster poured the metal, he gave the mold a sharp jerk upward, forcing the metal into every crevice of the matrix. Type was produced slowly and varied in quality with the skill of the casters.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A TYPE CASE holds the individual types which the compositor chooses by hand.

Modern Typemaking. Today, punches are engraved in an intricate and accurate routing machine which uses a raised metal pattern letter to guide its cutting tool. In this way the punches for Linotype, Monotype, and other composing machines are made. In these machines the types are rapidly cast and accurately finished without handwork.

Few punches for hand-set types are now made. The matrices for hand-set types are engraved, not punched, in soft steel, nickel, or brass from an intaglio, or sunken, pattern letter. The machine in which this is done can be set to produce any type size from one pattern letter.

Type metal is an alloy of lead, tin, antimony, and sometimes copper. The mixture is used to make metal flow more easily in Linotype and Monotype machines. The antimony makes the alloy harder and the cast sharper. The tin makes the metal easier to shape.

Type Sizes. Type sizes were originally known by name, but the sizes varied in each foundry. Then, about 1880, American foundries established a system of type-body measurement based on the size known as a "pica," which measured one sixth of an inch. The pica was divided into twelve parts, and each part was called a "point." Thus there are 72 points to an inch. Type sizes were indicated by the number of points the types measured. The point sizes here given are shown by the sizes of the printed characters:

This is 6-point type.

This is 8-point type.

This is 10-point type.

This is 12-point type.

This is 14-point type.

Type Fonts. Types are packaged and sold by weight, and the number of each character in a package is in accordance with a typefounder's "scheme." The separate collections are called "fonts." They contain capitals, small capitals, lower case, numerals, punctuation points, and other characters. They are designated by the number of capital *A*'s and lower case *a*'s they contain, the other characters being in the proper proportion to these letters. The number of each character in a font is governed by the frequency with which it occurs in the language for which the type is to be used. See also Printing.

TYPEWRITER, a machine for writing with types resembling those used in printing. A typewriter was invented in England as early as 1714, and in the following years many typewriters were invented. But it was not until 1874 that a practicable typewriter, the Remington No. 1, invented by C. L. Sholes, was offered for sale. Since then the typewriter has become indispensable to all activities in which speed and legibility in correspondence and other writings are required. The most important result of the invention of the typewriter was the mass entry of women into the business world.

The essential parts of a typewriter are a set of types; keys for bringing the types in contact with the paper; a paper carrier, or carriage; a *platen,* or roller, to support the paper against the types; and an inking device. In the kind of typewriter most widely used, each type is on the end of a pivoting bar that is joined to its respective key by a lever. The type bars are of such length and are so arranged that each type strikes at the same point. When a key is tapped, its type bar swings upward and its type strikes an inked ribbon against the paper, making an impression of the character. As the bar drops back, the paper carriage moves forward one space, putting the paper in position for the next letter. Spaces between words are made by striking a space bar at the base of the keyboard. Each type bar carries two types, either of which may be brought into use by manipulating a shift key, which either raises the paper carriage or lowers the type bars.

Other machines have the types arranged on wheels, cylinders, or curved plates. When a key is struck, the wheel or other device turns so as to bring the desired character into position to strike the paper. These machines are used chiefly where it is desirable to employ a number of different alphabets or styles and sizes of type, which are carried on the interchangeable type-bearing appliances. Some machines automatically "justify" the lines of words, making their right margins even. But the copy must first be pretyped so as to determine how much each line must be expanded or condensed; and before typing each line of finished copy the typist must set a dial or press a key to make the necessary adjustment. On proportional spacing machines wider spaces are given to broad letters such as *m* and *w* than are given to narrower letters like *n* and *u*, which are spaced wider than slender *i*'s and *l*'s. When justified lines are used along with proportional spacing, the typing can hardly be distinguished from printing.

Electric typewriters, whose keys act only as switches, may be operated at high speed for long periods with little fatigue on the part of the typist; and their types, being operated by electromagnets, strike the paper with uniform force. Some electric machines may be arranged in batteries, so that one typist may operate several of them simultaneously. An automatic typing machine operates on the player-piano principle, the keys being worked by compressed air blowing through slots in a record roll. Up to 160 paragraphs may be cut in the record roll, and by making selections from these by pushing appropriate buttons it is possible to write individual standard letters with the machine.

The "universal" keyboard, seen on most typewriters, was devised to separate the letters that are most often used together in English, thus keeping their type bars from clashing. A more scientific keyboard, on which the strongest fingers are used to type the letters that occur most frequently in English, has been designed, but because almost all typists learn on the universal keyboard and most offices have machines with universal keyboards, it is finding only slow acceptance. Typewriters are made with many other kinds of keyboards — to write in Braille, to compose music, to use the special symbols of chemistry and other sciences and professions. Even Chinese can now be typewritten. The Chinese machine, only about as large as a standard typewriter, is capable of producing 90,000 characters.

TYPHOID, *ti′foid,* **FEVER**, an infectious disease caused by a rod-shaped bacterium known to scientists as *Eberthella typhosa*. Typhoid bacteria gain entrance to the body through water supplies which have become contaminated with infected sewage and through food that has been handled by human carriers (people who are infected but show no symptoms) or that has been exposed to flies carrying the bacteria. One of the most famous typhoid carriers of all time was a cook known as "Typhoid Mary." This woman was responsible for at least ten typhoid outbreaks, involving hundreds of people.

A victim of typhoid fever suffers from ulcers in the intestine, and the spleen and the lymph nodes in the abdomen become enlarged. Ten to fourteen days after the bacteria enter the body the patient begins to have chills, headache, diarrhea or constipation, backache, nosebleed, and rising fever. Within a week or so a rose-colored rash usually breaks out on the abdomen or chest. In severe cases delirium and muscle twitches may occur, and serious complications, such as intestinal hemorrhage, perforation of the intestine, and disturbances of the circulatory (blood) or respiratory (breathing) mechanisms, sometimes develop. Identification of the bacteria in the patient's blood, urine, or excreta permits positive diagnosis of the disease.

The care of a physician is required in all typhoid cases. Though there is no specific remedy, chloromycetin and aureomycin are sometimes helpful. Good nursing care is essential, and the patient should be fed a nutritious, high-calorie diet. Since the disease is easily spread, typhoid patients should be isolated and their dishes, clothing, bedclothes, and excreta thoroughly disinfected. Preventive measures include early isolation of typhoid patients, purification of drinking water, pasteurization of milk, exclusion of typhoid carriers from food-handling positions, protection of food from flies, and typhoid vaccination. Immunity to typhoid fever can be brought about by a series of three injections of typhoid vaccine, followed by one booster injection each year.

TYPHOON′. See HURRICANE.

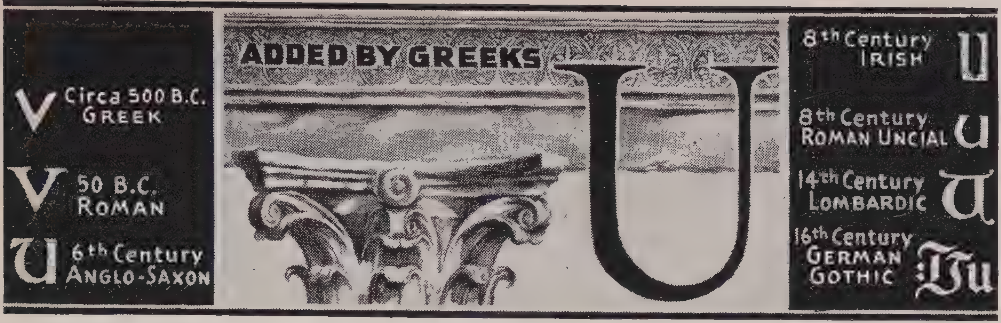
TYPHUS, *ti′fus,* an infectious disease caused by certain micro-organisms called *rickettsiae.* There are two kinds of typhus, epidemic and endemic. In *epidemic* typhus, also known as jail fever, ship fever, and camp fever, the rickettsiae are transferred from person to person by human body lice, and the disease normally occurs only where people live together in crowded, unsanitary environments. In *endemic,* or *murine,* typhus, a milder form, rat fleas are responsible for the spread of typhus organisms to man.

About eight to twelve days after a person becomes infected, the disease begins abruptly with chills, headache, high fever, prostration, muscular pains, and nervous symptoms. Within a few days a pink rash develops on the body; this later turns purplish and then brown. Delirium and other mental symptoms often appear but in most cases vanish when the patient's temperature returns to normal, around the fourteenth day. If death occurs, it is usually the result of complications, such as bronchopneumonia or severe damage to the nervous system. The treatment of typhus consists in complete bed rest, good nursing care, sufficient fluid intake, a nutritious diet, and drugs to relieve headache, restlessness, or other symptoms. Typhus can be prevented by the use of vaccines which establish immunity to the disease, by the application of DDT powder to clothing and bedding to kill body lice, by the eradication of rats, and by dusting rat holes and rat runs with DDT to destroy rat fleas.

TYRE, one of the most powerful cities of ancient Phoenicia, was situated on an island off the eastern coast of the Mediterranean Sea, south of Beirut and Sidon. It had a fine harbor, and more than a thousand years before Christ it was a commercial and industrial center. It became famous for its glassware, silks, and the dye called Tyrian purple. The island city valiantly resisted a long siege by Alexander the Great in 332 B.C.; to take it, he had to build a great causeway from the mainland to the island. Sand deposited by the sea eventually turned the causeway and island into a peninsula. Tyre flourished in Roman times and during the Crusades was a Christian stronghold. The Moslems then retook the city and left it in ruins. The ancient site is now occupied in part by the Lebanese town of Sur, which has a population of about 5,000. See also PHOENICIA.

TYRIAN, *tir′ih an,* **PURPLE.** See DYES AND DYEING.

TYROL, *tir′ol.* See TIROL.



U, the twenty-first letter and the fifth vowel in the English alphabet. The Greeks, and the Romans after them, took from the Semitic alphabet a V-shaped letter that stood for the modern sounds of *v* or *w* and made it serve as both a consonant and a vowel. Eventually the capital form of the letter stood for the consonant and the small letter, written *u*, for the vowel. In the seventeenth century the consonant *v* was given its own place in the alphabet, and *u* was retained as a vowel. In English, *u* has many sounds: long, like the *oo* in *cool;* somewhat shorter, as in *push;* short, as in *but.* It is often spoken as though there were a *y* before the vowel: *use, cure.* In words like *language,* it is sounded like *w. U* is silent in some cases where it comes after *g* or *q,* as in *guard, guest, oblique.* See also ALPHABET; V; W.

U-235. See URANIUM.

UAKARI, *wah kah'ree.* See ANIMALS (color section); MONKEY.

UFFIZI, *oof feet'see,* a palace in Florence containing a world-famous collection of art treasures. The palace was begun in 1560 for Cosimo de' Medici. The Uffizi galleries contain invaluable works of Fra Angelico, Botticelli, Raphael, Michelangelo, Titian, and other great masters. Connected with the Pitti Palace by a covered passageway, the Uffizi also houses the national library, with its treasured archives of old Tuscany. See also FLORENCE; PITTI PALACE.

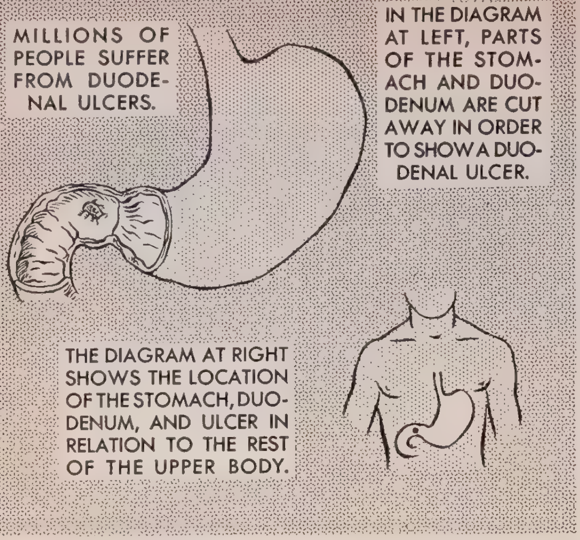
UGANDA, *yu gan'duh,* a British protectorate in equatorial Africa, covers an area of about 94,000 square miles between the Anglo-Egyptian Sudan on the north, Kenya on the east, Tanganyika on the south, and the Belgian Congo on the west. Lake Albert and Lake Edward are part of the western frontier; the southern border cuts across Lake Victoria, from which the Nile issues; and there are other large bodies of water, including Lake Kyoga. Much of central Uganda is hot and humid, with low, swampy areas, but in the west the land rises in grassy hills and plateaus which provide excellent farmlands and pastures. The storm-lashed Mountains of the Moon, or the Ruwenzori, rising well above 16,000 feet, are on the Congo border; on the east, where Uganda and Kenya meet, is Mount Elgon, an extinct volcano about 14,000 feet high. Clustered around the northern shores of Lake Victoria are the settlements of Jinja, Port Bell, Kampala, and Entebbe, the center of British administration.

Of a population numbering about five million, less than four thousand are Europeans. There are about 37,000 Asiatics, many of whom are village shopkeepers. The rest are African natives of various tribes, ranging from primitive Pygmies to the slender, aristocratic Bahima, who are often well over six feet tall. Both Negro and Hamitic stocks are represented. Some of the people are nomadic hunters, but most of them cultivate the land or raise livestock. The Bahima are famous for their great herds of cattle. Cotton is a major crop, and grains, vegetables, fruits, coffee, sugar, tea, tobacco, and rubber are produced. Hides and skins are exported. Uganda is a source of tin, tantalum, copper, and gold. Wildlife is abundant, and in the north is a large game reserve. Giraffes, elephants, hippopotamuses, rhinoceroses, zebras, gorillas, chimpanzees, and crocodiles are numerous.

Several native kings and chieftains rule in different parts of Uganda, but the people of Buganda are the dominant group in the protectorate. Their king, or *kabaka,* has his capital in Kampala. The British governor does not interfere in native matters, and local assemblies have considerable power. The rise of European influence began in the late 1870's, when the king invited Christian missionaries into Uganda. Rivalry among the various sects led to civil war, and in 1894 the British established the protectorate in order to bring peace to the country. Many of the natives are Christians. See also AFRICA.

UKRAINIAN, *yoo kra'nih un,* **SOVIET SOCIALIST REPUBLIC.** See RUSSIA.

UKULELE, *yu kuh la'lee,* a Hawaiian musical instrument belonging to the guitar family. Its ancestor was a Portuguese guitar called the *machete.* The ukulele has four strings and is played with the fingers. See also GUITAR.



MILLIONS OF PEOPLE SUFFER FROM DUODENAL ULCERS.

IN THE DIAGRAM AT LEFT, PARTS OF THE STOMACH AND DUODENUM ARE CUT AWAY IN ORDER TO SHOW A DUODENAL ULCER.

THE DIAGRAM AT RIGHT SHOWS THE LOCATION OF THE STOMACH, DUODENUM, AND ULCER IN RELATION TO THE REST OF THE UPPER BODY.

UL′CER, a hollowed-out sore on the skin or on any of the mucous membranes that line the digestive, respiratory, urinary, and reproductive tracts of the human body. Ulcers vary in size, location, and severity. They accompany such diseases as tuberculosis, cancer, syphilis, varicose veins, functional disturbances of the circulation, nutritional deficiencies, and local infection. The commonest and most troublesome variety is *peptic* ulcer, which occurs in the stomach or small intestine. Those in the stomach are also called *gastric* ulcers, those in the intestine *duodenal* or *jejunal* ulcers. Peptic ulcer occurs in 5 to 10 per cent of the total American population. Four times as many men as women suffer from ulcers. Most ulcer patients are between twenty and fifty years of age, but persons of any age may have ulcers.

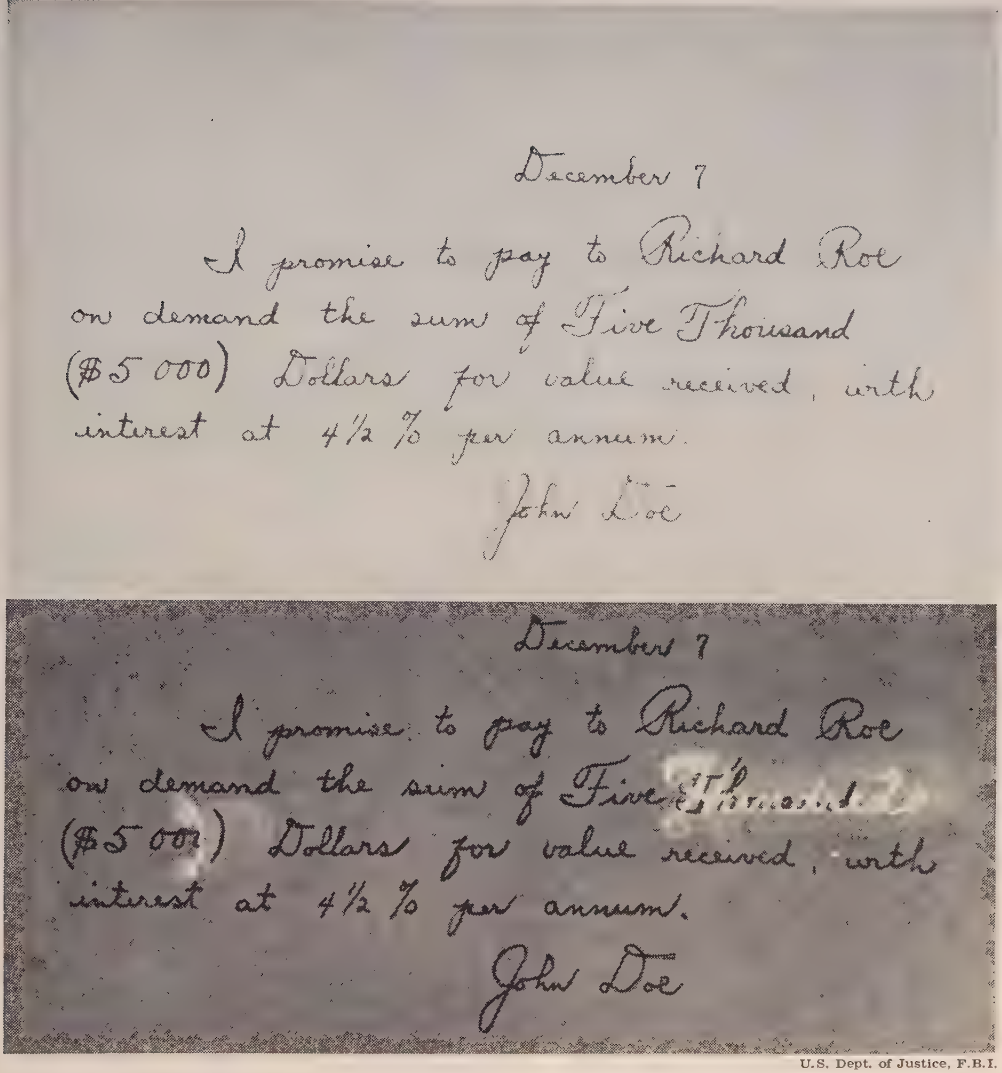
Causes. Not all of the factors that cause peptic ulcer have been discovered. It is known, however, that such ulcers result from the action of acid gastric juice (see GASTRIC JUICE) on the mucous lining of the stomach. Normally this juice simply aids in the digestion of food. But in some individuals it also begins to digest, or eat away, small areas of the stomach lining and in this way causes ulcers to form. Exactly why certain people and certain parts of the stomach are affected by the action of gastric juice is not completely understood. Worry and other nervous tension, too much acid in the gastric juice, changes in the blood supply of the stomach, faulty secretion of mucus in the stomach lining, injury or other damage to the stomach lining, or combinations of these conditions are believed to contribute to the formation of peptic ulcers.

Symptoms and Treatment. The most outstanding symptom of peptic ulcer is a gnawing or burning pain, which is so limited in area that the patient can often point out its location with one finger. The pain appears at definite times, usually several hours after each meal, and the victim gets prompt relief by eating or by taking antacids, such as bicarbonate of soda. After days, weeks, or even months it may disappear, but in most cases the disease is chronic and attacks occur again and again, particularly in the spring and autumn of the year. Persons with peptic ulcers should be under the care of a physician. The treatment for simple ulcers consists in complete physical and mental rest, strict adherence to a bland diet, and the administration of drugs which aid in healing the ulcer by counteracting stomach acids and by cutting down the muscular movements of the stomach.

Complications. Occasionally, complications such as perforation, hemorrhage, or obstruction may occur. In perforation the ulcer gradually eats its way entirely through the wall of the stomach or intestine, perhaps causing peritonitis (see PERITONITIS). The patient's abdomen becomes rigid, and he suffers extreme pain. A surgical operation is usually required to close the perforation, or opening. When an ulcer invades a large blood vessel, massive hemorrhage occurs and the patient either vomits large amounts of blood or eliminates it in the feces. Treatment includes hospitalization, a bland diet, and if necessary, blood transfusions or surgery to tie off the injured blood vessel. In ulcer cases, obstruction of the opening between the stomach and intestine is often due to swelling of a nearby ulcer or the formation of too much scar tissue. Since the digested food cannot enter the intestine, it is vomited up. Surgery is frequently necessary to relieve the obstruction.

UL′STER, the northeastern part of Ireland, was one of the early Irish kingdoms, and after the English took possession of Ireland it was one of the four provinces of the country. In the seventeenth century Scottish and English settlers, who were mostly Protestant, established themselves in Ulster, and during the long struggle between Ireland and Great Britain the people of Ulster generally sided with the English. When southern Ireland achieved self-government as the Irish Free State in 1921, six of the Ulster counties were formed into Northern Ireland, which remained a part of the United Kingdom. The three southern counties (Cavan, Donegal, and Monaghan) joined what is now the Republic of Ireland. Northern Ireland is still often called by the old name of Ulster. See also IRELAND.

ULTIMA THULE, *ul′tih muh thyu′lee* (farthest Thule), a figurative expression meaning the most distant of lands. Thule was the name given by Pytheas, a Greek navigator and geographer of the fourth century B.C., to a land north of Britain. He described it as often blanketed by fog and told how the



December 7

I promise to pay to Richard Roe on demand the sum of Five Thousand ($5 000) Dollars for value received, with interest at 4½ % per annum.

John Doe

December 7

I promise to pay to Richard Roe on demand the sum of Five Thousand ($5 00) Dollars for value received, with interest at 4½ % per annum.

John Doe

U.S. Dept. of Justice, F.B.I.

ULTRAVIOLET LIGHT BRINGS OUT THE ORIGINAL figure on the note (bottom), which was erased with chemicals so that a figure ten times higher could be substituted (top).

sun in midsummer stayed above the horizon most of the night. Later explorers failed to identify Thule, which Pytheas thought was the northernmost part of the world. It may have been Iceland or part of Norway.

ULTIMATUM, *ul tih ma'tum,* a proposition or demand made to either of the parties in an international dispute. It may include a time limit for a reply or course of action and is sometimes the last step in negotiations that lead to war.

ULTRAMARINE, *ul truh muh reen',* an intense-blue pigment used in preparing oil paints and water colors, was once made by crushing and powdering lapis lazuli, a semiprecious stone. It was highly valued as a beautiful, permanent color, but it was very expensive. In 1814 artificial ultramarine, a mixture of kaolin, sodium, sulfur, and charcoal, was produced accidentally in the soda furnaces of St. Gobain, France, and since then it has been abundant and inexpensive. It is also used as a dye in various industries.

ULTRAVIOLET RADIATION or **RAYS**, a radiation of the same nature as light but shorter in wave length (see ELECTROMAGNETIC THEORY OF LIGHT; LIGHT). The human eye is not sensitive to the ultraviolet portion of the spectrum, which extends from the short wave-length end of the visible region, at the violet, to the beginning of the X-ray region. These rays are emitted by the sun, a welder's electric arc, a mercury-vapor lamp, and many other luminous sources.

AMONG THE MANY DANGERS FACED BY ULYSSES and his men was the attack by the giant Cyclops, who hurled boulders at their little ship.

All but the longer waves of the ultraviolet light from the sun are completely absorbed in passing through the earth's atmosphere (see ABSORPTION, *Absorption of Energy*). The part absorbed produces layers of ionized (electrically charged) particles in the upper atmosphere that reflect radio waves back to the earth, making long-distance radio transmission possible (see RADIO, *Propagation*). Some of the wave lengths that get through cause sunburn, kill germs, produce vitamin D in the body, and have other biological effects.

Ordinary glass does not transmit the ultraviolet, hence artificial sources that are enclosed in glass must have windows of quartz or fluorite to let the rays through. Lenses and prisms for optical systems used in studying this region must also be made of these materials.

Uses. Carefully controlled ultraviolet radiation is used by doctors to cure or prevent rickets and to treat other conditions. Hospitals use it to kill air-borne germs in nurseries and operating rooms. Long or repeated exposure to these rays can damage the eyes, burn the skin and other tissues, and even cause cancer of the skin.

An important commercial use is the production of vitamin D in foods like cereals and milk by irradiating them with ultraviolet light. It is also used to kill or retard the growth of germs, molds, and fungi in dairies, brooder houses for baby chicks, refrigerators, and on cups and glasses in restaurants. These rays can be used as well as the visible and infrared rays to produce the flow of electrons in photoelectric tubes by means of which many industrial processes and devices are controlled.

When ultraviolet rays fall upon fluorescent materials, energy is absorbed from the radiation and re-emitted in the visible region, thus making the materials luminous (see FLUORESCENCE). The most familiar application of this effect is the ordinary fluorescent lamp. The ultraviolet light, which we cannot see and which does not get outside the lamp tube, makes the coating inside the tube fluoresce and produce the light we see. Many minerals, dyes, and detergents have a characteristic fluorescence by which they may be identified, and adulterants, secret messages, forgeries, and counterfeits of some kinds of documents can often be detected in this way. Even the freshness of eggs and the authenticity of paintings are tested by fluorescence under ultraviolet light. (See previous page.)

ULYSSES, *yoo lis'eez,* a commonly used name for ODYSSEUS, one of the great heroes of Greek mythology. The Romans called him Ulixes. Ulysses is the leading character in Homer's *Odyssey* and an important figure in the *Iliad.* He also appears in other early Greek epics, but the Ulysses whose portrait is still vividly alive after nearly three thousand years was created by the genius and imagination of Homer.

According to Homer, Ulysses succeeded his father, Laertes, as king of Ithaca, a rocky island off the western coast of Greece. He married Penelope, the beautiful and clever daughter of a Spartan prince. Not long after the birth of their son Telemachus, Ulysses joined the other Greek chieftains in the expedition against Troy, contributing twelve ships and their crews to the fleet.

As is told in the *Iliad,* he performed many brave deeds during the ten-year siege of Troy, and after the death of Achilles he was chosen by the other leaders to wear the hero's golden armor as the greatest among them. Ulysses was much admired for his crafty wisdom and guile. He helped to steal the sacred image of Athena from the doomed city, and he devised the scheme of the wooden horse, by which Troy was finally taken and sacked.

After the fall of Troy, Ulysses set sail for home, but the Greeks had aroused the wrath of two powerful deities — Athena, goddess of wisdom, and Poseidon, ruler of the sea. Athena, who was usually the protector of the wily Ulysses, soon relented and helped her favorite, but Poseidon did not forget his anger. The journey home took ten years, and Ulysses had many narrow escapes from death. The story of his adventures is told in the *Odyssey.*

When at last he reached Ithaca, alone and disguised as a beggar, he had to find a way of ridding his palace of a crowd of nobles who were paying court to Penelope. Each of them, believing that Ulysses was dead, hoped to win his kingdom and his queen. Penelope and Telemachus could not put the suitors out of the palace by force, and the queen had to invent many reasons for not making a decision among them. With the help of his son and two loyal retainers, Ulysses killed most of the suitors in a wild combat. He then revealed himself to the faithful Penelope and took his place once more as king of Ithaca. See also ILIAD; ODYSSEY; TROJAN WAR.

UMBELLIFERAE, *um beh lif'ur ee.* See PARSLEY.

UMBER, an earth pigment used by painters in its raw state to produce a greenish-brown color and heated to produce a warm reddish brown called *burnt* umber. The clay, which contains iron and manganese oxides, is dried and ground and then mixed with oil. Umber is found throughout Europe and in many parts of the United States. *Turkey* umber, famous for its excellence, comes from the island of Cyprus.

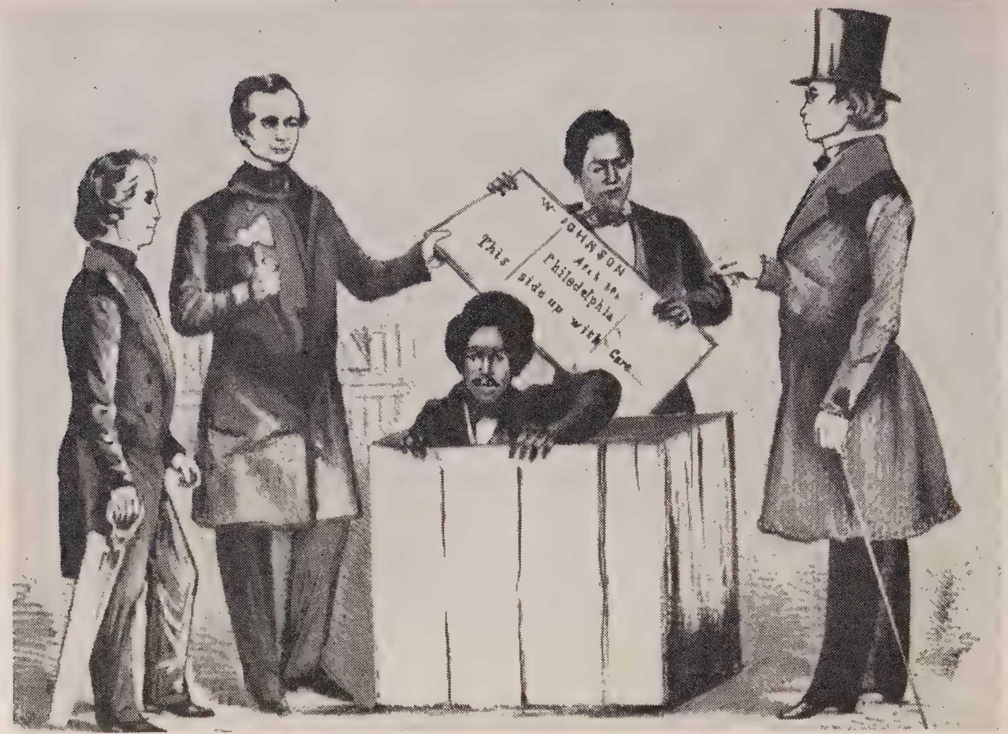
UNALAS'KA. See ALEUTIAN ISLANDS.

UNCAS, *ung'kus* (about 1588-1683), the chief of the Mohegan Indians, who occupied the territory along the Thames River in Connecticut. He was the son of a Pequot sachem, but he led a revolt against the leaders of his tribe and became chief of the western band, called Mohegan. He helped the English to defeat and scatter the Pequot and later laid claim to their territory. In 1640 and 1659 Uncas ceded large portions of the Mohegan land to the colony of Connecticut. These deeds resulted in litigation which kept the case before the courts until a decision in favor of the colony was finally reached in 1773. See also MOHEGAN.

UNCLE SAM, the name of an imaginary character representing the United States, as John Bull represents England. The name was probably derived from the initials *U. S.* stamped on government property. In the early years of United States history Brother Jonathan was the common term. While the name Uncle Sam was used occasionally after 1834, it was not until the last quarter of the century that the cartoonists developed the conventional figure that is accepted today as a symbol of the United States and its government. See also JOHN BULL.

UNCTION, *ungk'shun,* EXTREME, a sacrament of the Roman Catholic Church, is administered to the dying or those in danger of death from sickness, injury, or old age. In this sacrament the priest dips his thumb in olive oil that has been blessed by the bishop on Holy Thursday, and with it he makes the sign of the cross on the eyes of the person who is near death, saying, "Through this Holy Unction and His most tender mercy, may the Lord forgive you whatever sins you have committed by seeing." He repeats this as he anoints the ears, nose, mouth, hands, and feet, changing the last word to fit the gesture. By this rite sins are remitted, and spiritual health and strength are given. It is one of the last rites of the Church.

UNDERGROUND RAILROAD, a secret system set up by Northern abolitionists to assist fugitive slaves to escape to the free North and to Canada in the years between 1838 and 1861. Antislavery sympathizers arranged routes, chiefly through Illinois, Indiana, Ohio, and Pennsylvania, with private homes as stopping places where the fugitives might eat and rest in safety. The routes were called *lines;* the guides were *conductors;* stopping places were *stations* or *depots;* and the slaves were known as *freight* or *packages.* The Underground Railroad's president was Levi Coffin, an Indiana storekeeper, and the stockholders were the men and women who contributed money, food, and clothing to help the runaways. An estimated 75,000 slaves passed through the Underground Railroad during the period of its operation. Traffic was heaviest after the passage of the Fugitive Slave Law in 1850, in spite of the increased fines and penalties which the statute imposed on those convicted of aiding escaped slaves. See also FUGITIVE SLAVE LAWS; SLAVERY.


W. JOHNSON
Arch Str.
Philadelphia
This side up with care.

Brown Brothers

THE UNDERGROUND RAILROAD helped fugitive slaves in many different ways. This slave was shipped from Richmond to Philadelphia in a packing case labeled "This side up."

UNDERWRITING. See INSURANCE, *Insurance Companies.*

UNDULANT, *un'dyoo lant,* **FEVER**, or **BRUCELLOSIS**, *broo seh lo'sis,* an infectious disease occurring most often among farmers, veterinarians, and slaughterhouse workers. Undulant fever, also known as *Mediterranean fever* and *Malta fever,* is caused by three types of rod-shaped bacteria *(Brucella),* which are found in cattle, hogs, and goats. The type infecting cattle causes Bang's disease in cows (see BANG'S DISEASE). Human beings get undulant fever by drinking unpasteurized milk from infected animals and by handling diseased animals and their carcasses. The disease comes on slowly, with vague muscular pains, headache, and evening fever, followed by sweating. The patient's temperature becomes higher and higher each evening until it reaches about 105°F., then drops to normal for a variable length of time. The attacks of fever usually recur in waves, hence the name undulant fever (from *undulate,* meaning *to rise and fall*). Persons suffering from undulant fever should be under the care of a physician. Vaccines and antibiotics, such as streptomycin, aureomycin, and chloromycetin, are effective means of treatment. See also DISEASE, *Communicable Diseases.*

UNEMPLOYMENT. One of the chief problems in modern industrial society is to bring together the available jobs and the available workers. On the one hand are the employers who have jobs to fill and on the other are the millions of workers who make up the labor force. Jobs and workers are never exactly in balance. In such a large group, job changing is frequent. A worker may shift from one job to another because he can get better wages, have more opportunity for advancement, or work under better conditions. He may be out of work temporarily, but it is by choice. There are also many workers who lose their jobs through no fault of their own and have difficulty in finding other positions. They go through a period of *unemployment.*

Unemployment means being out of work, but people who are idle because of some disability or because they do not need to work and those who are temporarily laid off but expect to go back to their jobs in a reasonable time are not counted as unemployed. An unemployed person is defined as someone who is able to work, wants to work, and is unable to find a suitable job.

Causes of Unemployment. In an industrial country like the United States there is always some unemployment, even in times of great prosperity. It is estimated that under normal conditions about 5 per cent of the workers are idle. In abnormal times of business crisis the percentage may be much higher. In 1933 about one man in every four was out of work. The chief reasons for unemployment are the invention of machines that take the place of manpower, the seasonal character of some kinds of employment, changes in the demand for manufactured products or in the methods of production, and the depressions that seem bound to happen from time to time.

Using machines to do the work of men creates unemployment, and men who lose their jobs because of these technological improvements may have difficulty in finding other work, but in the long run the use of efficient machinery increases production, reduces costs, and eventually creates new jobs instead of cutting down the number of workers needed. In spite of the fact that more and more work is being done by machines instead of manpower, more people are working than ever before.

Most of the industrial countries of the world are in the temperate zones, where climate and weather cause many ups and downs in employment. Agricultural workers, people in some service industries like the summer or winter tourist trade, and workers in industries that have a rush followed by a slack period are likely to suffer from seasonal unemployment. Styles change with the seasons, and manufacturers bring out new lines at regular intervals. When the demand slackens, workers are laid off. The use of coal is partly seasonal, and that is one reason why miners are employed irregularly.

Businesses fail for one reason or another, products cease to find buyers, and sometimes industries are moved from one part of the country to another. Men lose their jobs, but unless these changes come during a period of falling wages, falling prices, and reduced production, new business ventures are undertaken, and new products are put on the market. Sooner or later the unemployed worker finds a new job.

Effects. Unemployment rising out of the development of machinery or improved methods of production, out of the seasonal ups and downs of business, or out of ordinary changes in industry cannot be prevented. Unemployment can be very hard on the individuals who are forced to move to another region, to learn new skills, or to accept an inferior kind of job, but the consequences are not serious for the country as a whole. If there were no unemployed workers any new business could be staffed only at the expense of some older establishment.

The kind of unemployment that comes with a business depression is a very serious problem for society. A man who is out of work for a long time eventually loses his savings, his property, and perhaps his health. His special skills grow rusty, and he loses confidence in himself. He ceases to be a consumer and a purchaser of goods that other workers have produced. Instead of being an asset to the community, he may be a burden. He may lay the blame for his troubles on the economic system, lose faith in his government, and be tempted by propaganda about other economic and political systems.

Aid for the Unemployed. Unemployment arising from economic crises can be prevented only by preventing business depressions, if that is possible, but people who are jobless can be helped to find the available jobs, and unemployment-insurance benefits can make it easier for the worker to get through a period of unemployment. In almost all of the industrial countries a system of public employment agencies and a system of unemployment insurance have been established. The public employment agencies keep records of the jobs that are open and send applicants to employers who may hire them.

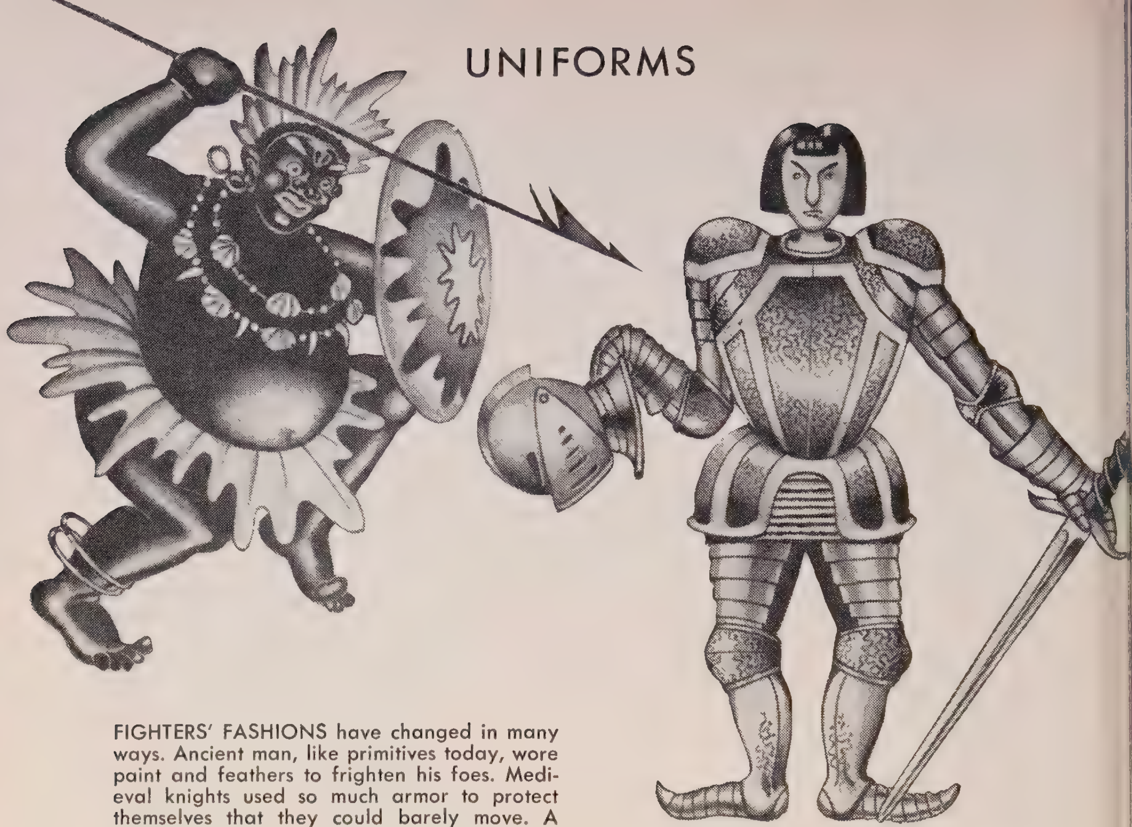
The United States Employment Service, which was established in 1933 and later became part of the Bureau of Employment Security, in the Department of Labor, gives supervision and assistance to the state employment agencies, publishes information about jobs, and offers some direct help in finding jobs for farm workers and for veterans. Private employment agencies charge a fee for job placement, but the state and Federal agencies provide this service without charge. Millions of workers are placed every year.

In 1911 Great Britain set up a plan for compulsory unemployment insurance, and other European countries accepted the idea. In the United States, job insurance was one of the provisions of the Social Security Act, which was passed in 1935. Funds for unemployment compensation come from payroll taxes paid by employers. Not all employers are required to pay this tax, and not all workers are insured.

When an insured worker loses his job through no fault of his own and does not succeed in finding a new one, he reports to the public employment agency and files a claim for unemployment benefits. If no suitable job can be found for him, he may receive payments from the fund for a limited time. The amount of his check depends on the amount of his wages during the time that he was on a payroll subject to tax. If he refuses to take a job for which he is fitted and which meets the standards set by the Federal Government, he is no longer entitled to unemployment compensation.

People used to assume that an idle worker

UNIFORMS



FIGHTERS' FASHIONS have changed in many ways. Ancient man, like primitives today, wore paint and feathers to frighten his foes. Medieval knights used so much armor to protect themselves that they could barely move. A little more than a hundred years ago, European soldiers were going into battle in the elaborate costume of the parade ground. The modern uniform is designed to provide maximum comfort while attracting the least attention.

did not want work, and the unemployed were liable to punishment. It is now recognized that unemployment is a part of the economic system and that society has to find ways of dealing with it.

UNEMPLOYMENT INSURANCE. See Unemployment.

UNES′CO. See Nations, United.

UNGULATES, *ung′gyoo layts,* or **UNGULATA,** *ung gyoo la′tuh,* a term loosely applied to plant-eating mammals with hoofs. The Ungulata once ranked as an order of the class Mammalia, but the various types of ungulates are now placed in separate orders (see Mammals). *Odd-toed* ungulates (those with one or three toes) include horses, tapirs, and rhinoceroses. *Even-toed* ungulates (those with two or four toes) include pigs, peccaries, hippopotamuses, and the cud-chewing animals, such as cattle, sheep, goats, deer, antelopes, giraffes, camels, and llamas. For further information consult articles on the animals mentioned above.

UNICORN, *yu′nih kawrn,* a mythical animal, resembling a horse, with cloven hoofs and a single horn projecting from the center of the forehead. The unicorn described by ancient Greek writers may have been a rhinoceros or an antelope, but their descriptions caught the imagination of medieval storytellers, who created many myths about the animal. Its red, black, and white horn was said to be an antidote for all poisons; during the Middle Ages learned men solemnly discussed its medicinal value. According to legend, the unicorn could be captured and subdued only by a maiden, to whom it would surrender voluntarily. The unicorn appears in many medieval tapestries.

UNIFORM, clothing of a particular color and style which shows that the wearer belongs to some special group of people. Usually the uniform tells what the wearer's occupation is. In all branches of the armed services men and women wear uniforms. According to the rules of warfare a soldier who does not wear a uniform or insignia is considered an outlaw. In civilian life policemen, firemen, postmen, nurses, and guards are only a few of the people who wear uniforms when they are at work. Sometimes a uniform is a very practical kind of dress, and often it is useful as identification, but there are also many kinds that are designed for color and show. Wearing a uniform helps to build up group spirit.

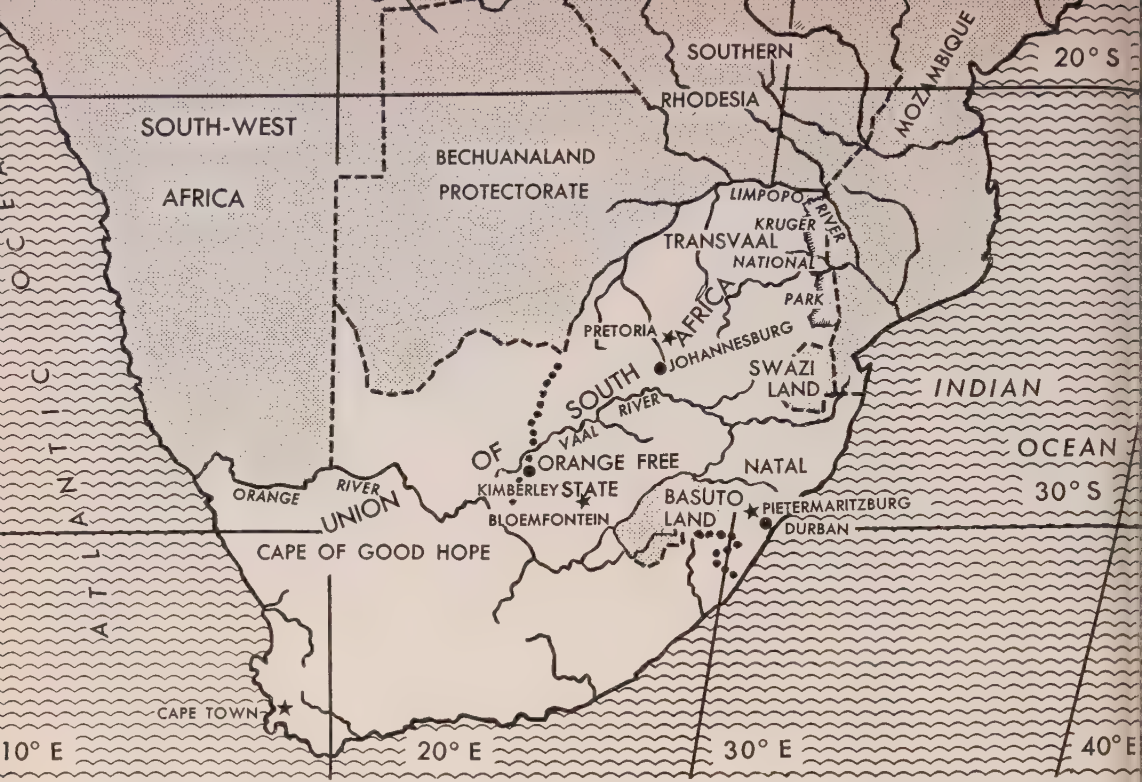
In modern times members of the armed forces of any nation wear distinctive uniforms, but in feudal days there were no national armies and no national uniforms. Noble lords had their own troops of retainers, who often wore liveries based on the family colors. When the great nations began to develop, the king's troops formed a kind of national army. In the seventeenth century British and French soldiers in the service of the king wore distinctive uniforms, but it was the duty of an officer to provide uniforms for the men under his command.

For a long time uniforms were bright in color; those of the officers were extremely elaborate and conspicuous. After the rifle was invented, enemy marksmen could single out the brightly clad officers as special targets and pick them off one by one. English troops fighting in the French and Indian Wars found that scarlet uniforms put them at a great disadvantage when they came up against an enemy that could hide in the forest, strike unexpectedly, and then vanish.

In modern armies, ordinary field uniforms are drab in color — khaki, grayish green, or grayish blue — because these colors blend with the landscape and afford some concealment. Soldiers fighting in the snow usually wear white uniforms, and naval uniforms are generally blue, gray, white, or khaki. Designers try constantly to improve the uniforms to be worn on active duty. Battle dress must be practical and comfortable and must give the wearer as much protection as possible. When a war is worldwide, uniforms must be adapted to fit the climate and weather conditions of many very different regions.

UNION, Act of, an act passed by the British Parliament in 1840, uniting Upper Canada (Ontario) and Lower Canada (Quebec) into a single province. The act, which was based on the Earl of Durham's famous *Report on the Affairs of British North America* (1839), came into effect in 1841. Under its terms each of the former provinces sent an equal number of representatives to the legislative assembly; representation was not based on population. The real power was in the hands of the governor, who was assisted by a legislative council. During the next quarter of a century Canadians fought for and gradually acquired greater political responsibility, and in 1867 the self-governing Dominion of Canada was established. See also Canada, Dominion of.

UNION OF SOUTH AFRICA, a self-governing dominion in the British Commonwealth of Nations, occupies the southern tip of the African continent. On the east, south, and west it is bounded by the sea. To the northwest is South-West Africa, a territory under mandate to the Union. Bechuanaland and Southern Rhodesia are on the northern boundary, and Mozambique (Portuguese East Africa) lies to the northeast. The Union includes an area of about 374 square miles around the port of Walvis Bay in South-West Africa, but the native territories of Swaziland and Basutoland, which are within the boundaries of South Africa, are not part of the Union.



The Union is made up of four provinces: the Province of the Cape of Good Hope, or the Cape Province, with a long coastline on the Atlantic and the Indian Ocean; Natal, along the southeastern coast; the Orange Free State, in the east-central region; and the Transvaal to the northeast. The total area of the Union is about 472,550 square miles.

Geography. For the most part the coastline is regular, with only a few good harbors. The coastal plain is generally narrow, and often the land rises sharply from the sea. The interior is a great rolling plateau from 4,000 to 6,000 feet high. Mountain ranges marking the division between the coastal lands and the plateau follow the curve of the coast. Inland from the eastern shoreline the Drakensbergen, or Dragon Mountains, reach heights of more than 10,000 feet. The western part of the Cape Province, near Cape Town, is well-watered, fertile country that produces fine fruits, vegetables, and wines. Between this region and the grasslands, or high veld, of the interior are the semiarid plateaus called the Little and the Great Karroo, which support large flocks of sheep and herds of cattle, even though the vegetation is scant. The high veld is chiefly given to livestock raising and farming.

On the north and west are some extensions of the tropical deserts, and many regions that are cut off by the mountains from the moisture-bearing sea winds suffer from frequent droughts. There are many streams that flow down from the mountains to the sea, but the interior is watered principally by the Orange River, which empties into the Atlantic, and the Limpopo, which flows into the Indian Ocean. The Vaal, a main tributary of the Orange, brings water to the great gold-mining district of the Witwatersrand, or White Waters Ridge, in the southern Transvaal, and to the gold fields in the Orange Free State. From the Rand's remarkable deposits of gold-bearing ore comes a large part of the country's wealth.

There are few trees in the veld country, though there is some forest land in the southern part of the Cape Province. Most of the wild animals in the Union are in the protected game reserves like Kruger National Park in the northeastern corner of the Transvaal. Antelope, zebras, giraffes, hyenas, lions, and elephants are seldom seen except in these reserves.

Climate. Although the Tropic of Capricorn cuts across the northern part of the Transvaal, the climate of South Africa is generally very pleasant and healthful. Because of the altitude, summer nights are usually cool, and the sunny winter days are not extremely cold. The South Africans enjoy living in the open air, and they think their climate the finest in the world. Natal, between the high mountains and the Indian Ocean, has a subtropical climate suitable for sugar plantations.

Agriculture. In addition to the orchards, vineyards, sugar plantations, and mixed farms of the coastal regions, South Africa has large cattle and sheep ranches on the high grasslands and the lower plateaus. Milk, butter, beef, hides, mohair (from Angora goats), wool, and sheepskins are important products. Though the veld is best suited to grazing, corn (called *mealies*) is raised on most of the farms, and barley, rye, oats, tobacco, cotton, and peanuts are grown in some regions. Only about one sixth of the land is cultivated.

Industry. Much of the revenue of the country comes from mining industries. The gold mines of the Rand produce more than one third of the world's supply of gold, and this single industry employs a large labor force, the greater part of which is recruited from the territories outside the border of the South African Union. Another large deposit of gold-bearing ore has been found in the northern part of the Orange Free State, and when this gold field is developed it may prove to be even richer than the Witwatersrand. One tenth of the world's diamond supply comes from South Africa. Other minerals are coal, iron, copper, tin, lead, nickel, and asbestos. The Union exports minerals, wool, sugar, hides, fruits, and wines, and imports machinery, petroleum, and some wheat. Trade is chiefly with Great Britain and the members of the British Commonwealth, the United States, and, in normal times, Germany.

The People. The Union has a total population of about 12,400,000. Of this number about 8,400,000 are native Africans (chiefly Bantu), more than 350,000 are Asiatics, and about 1,000,000 (called Colored) are of mixed blood. The remaining 2,600,000 are of European descent. More than half of these are descended from the Dutch farmers, or Boers, who, with some French Huguenots and some Germans, originally settled much of the territory. Their language, which is called Afrikaans, is related to Dutch. About 40 per cent of the Europeans are of British stock. Both English and Afrikaans are official languages in the Union, and government employees must be able to speak both of them fluently. The native languages are mostly Bantu dialects.

The Boers, or Afrikaners (also spelled Afrikanders), were originally farmers and ranchers, living on large, isolated ranches, while the British tended to settle in the cities. The rural people are still mostly Boer, but a number of Afrikaners moved into the cities as industry developed. Both Boers and English share in the political administration of the country. Because of differences in language, customs, and ways of living, the Boers and the English tend to divide into separate political groups. The National Party is chiefly Boer, the United Party mainly British.

The people classified as Colored are the descendants of mixed marriages between Europeans, Hottentots, Bantus, and East Indians. Most of them are in the western part of the Cape Province. The Asiatics are mainly East Indians. They were brought into Natal to work on the sugar plantations in the early days when the Africans were unwilling to take such jobs, and other Indians followed. They are still concentrated mainly in the region around Durban, the great seaport in Natal.

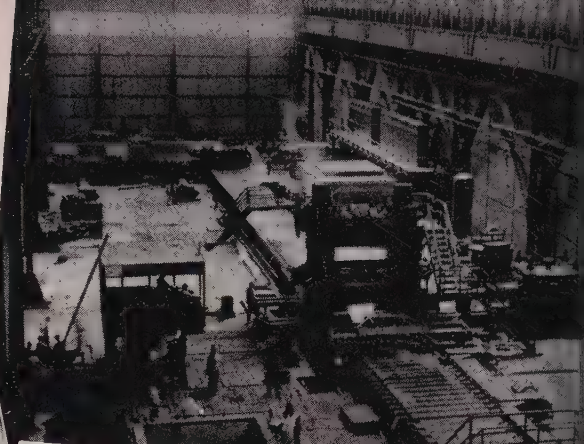
The native Africans, who make up about two thirds of the population, belong mainly to Bantu-speaking tribes like the Zulu and the Basuto, who migrated into South Africa from the regions around the equator. Most of them live as farmers and stockmen on lands reserved for their use. They farm in the traditional ways and live in huts like their ancestors. Tribal custom is still law.

The reserved lands suffer from erosion because of poor methods of farming, overgrazing, and insufficient rainfall. Many Africans leave the reserves to find jobs on the European ranches and farms and in the cities. In earlier times these workers spent only a part of the year away from their homes, but eventually nearly two million settled permanently in the towns. Farm workers were drawn into industry by the higher wages offered. Most of the labor force in South Africa is provided by these native workers. They are house servants, farm hands, unskilled and semiskilled laborers in the mines and industrial plants, and teachers, doctors, policemen, or technicians trained to work among their own people.

According to the official policy of segregation, which has been in force since 1913, the Africans, generally speaking, are required to live in the reserves or in specified townships in the cities. Some areas place restrictions on native ownership of land, though large numbers of native Africans live in European territory as tenant farmers, farm laborers, domestic servants, or as employees on company property. The more recent name given this policy of segregation is *apartheid,* or apart-ness. Legislation passed in 1950 made it possible to have areas set aside for one or another racial group alone.

Religion. More than 95 per cent of the European population and about half of the natives are Christian. The majority are members of the Dutch Reformed Church, but many other denominations are represented. The churches have been active in missionary work and education. There are about 108,000 Jews in the Union, some of them refugees from Nazi persecution in Central Europe.

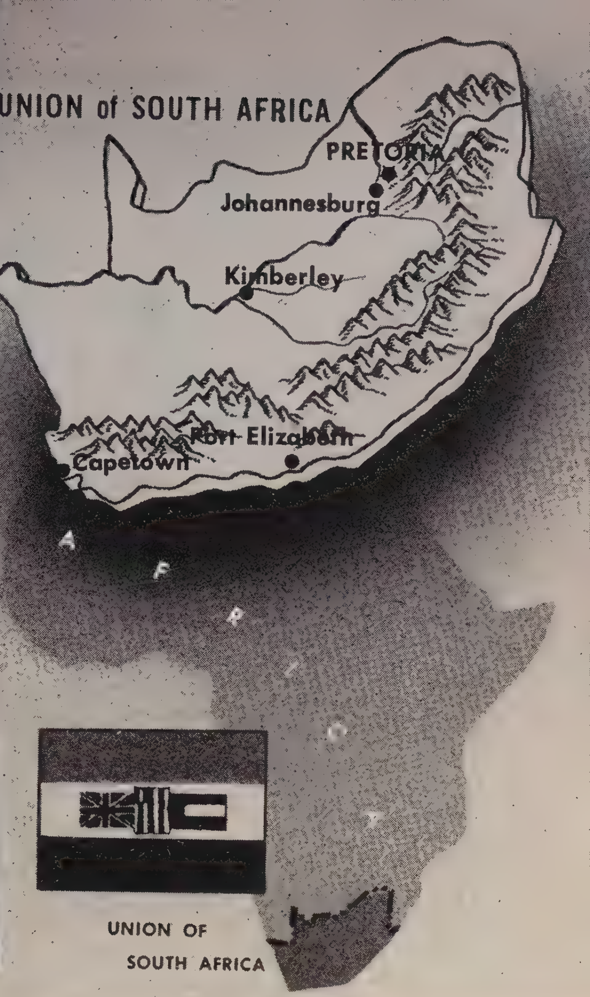
Cities. More than a tenth of the total population of the Union is found in the four largest cities: Pretoria (242,000), Cape

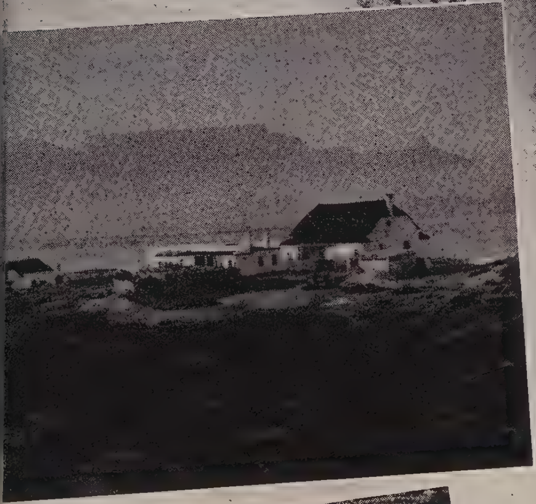


N. W. Ayer and Son; S. A. Official Photos

THE PEOPLE AND THEIR WORK

Top, left: Diamond sorting. Top, right: Steel milling. Center: Grape culture. Bottom, left: Transkei natives, Cape of Good Hope province. Bottom right: Wool production and manufacture.

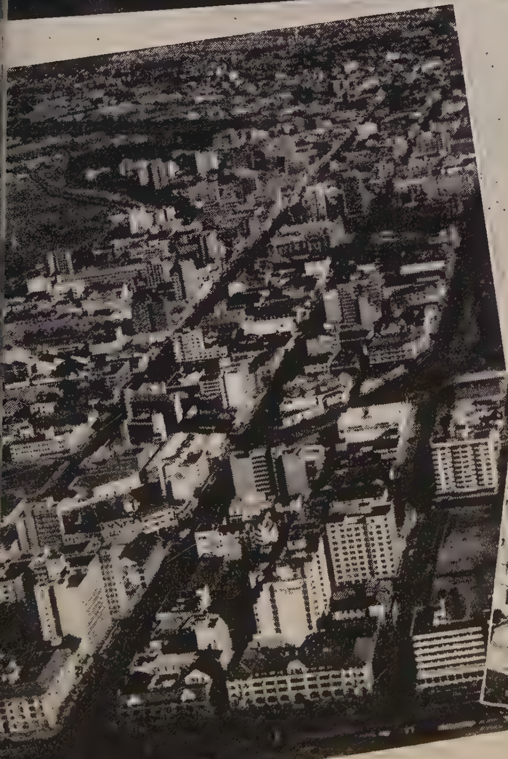


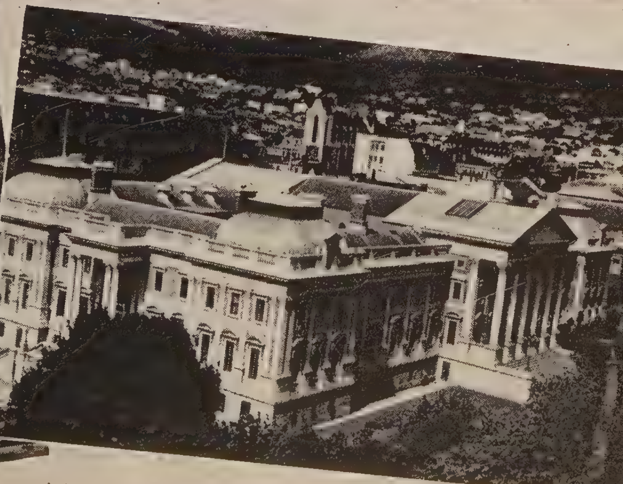


S.A. Official Photos

THE SOUTH AFRICAN SCENE

Britain's South African dominion is a land of contrasts. Top: Wildebeests and zebras in Kruger National Park. Center: Table Mountain, as seen across Table Bay, near Cape Town. Bottom, left: Aerial view of Durban, seaport of Natal. Bottom, right: Houses of Parliament, in Cape Town.





South African Railways

A CITY BUILT ON GOLD, Johannesburg is a modern metropolis in the Union of South Africa.

Town (454,000), Durban (374,000), and Johannesburg (839,000). Pretoria, which is the administrative capital of the Union, is also the capital of the Transvaal. Cape Town, the seat of the Union Parliament, is the capital of the Cape Province. The other provincial capitals are Bloemfontein in the Orange Free State and Pietermaritzburg in Natal. East London and Port Elizabeth rank below Cape Town and Durban as ports. Kimberley, in the Cape Province, is the chief center of diamond production. Johannesburg, the largest city in the country, owes its rapid growth to the gold mines of the Rand. Many people came to the Transvaal to seek a share of the gold, and many industries, commercial firms, and banks were established.

Education. The provinces of the Union provide about 3,000 schools for European children and about 6,000 for natives. Of some 1,300,000 children, about 417,000 are of European descent. The national government supervises many kinds of special schools. The University of South Africa is made up of several divisions called university colleges, located in various parts of the country. The university also includes the South African Native College in the Cape Province, near Fort Hare. Most of the 20,000 college students attend the eight independent universities: the University of Cape Town, the University of Stellenbosch, the University of Pretoria, the University of Natal, the University of the Orange Free State, Rhodes University, Potchefstroom University, and the University of Witwatersrand at Johannesburg. Non-European students are admitted at Witwatersrand and Cape Town.

Government. The Governor-General, who is appointed by the king on the advice of his South African ministers, represents the British Crown in the Union Government, but the country is actually governed by its own Parliament, which must meet at least once each year. The Parliament includes the Governor-General and the Executive Council, or Cabinet, which is headed by the Prime Minister; the Senate; and the House of Assembly. The Senate has forty-eight members. In each province eight are chosen by the members of the provincial council and the House of Assembly; four more are elected as representatives of the natives. The eight remaining Senators are nominated by the Governor-General, and four of these are also chosen for their knowledge of native affairs. South-West Africa sends representatives to the Senate (two elected and two nominated). The House of Assembly may have 163 members, three of whom are elected by the natives of the Cape Province. Six are from South-West Africa and four may be elected by the Colored people of the Cape Province and Natal. In general only Europeans twenty-one years of age or older may vote, and all members of Parliament must be Europeans. Cabinet ministers must be members of Parliament.

Each province is governed by an administrator, who is appointed by the Governor-General, and a provincial council, which corresponds to the House of Assembly. Two members of the Cape Assembly may be non-Europeans. Four members of the council are chosen as the executive committee.

The law of the land is Roman-Dutch, as brought from the Netherlands by Dutch emigrants in the seventeenth and eighteenth centuries. The Supreme Court has divisions in each of the provinces. There are also special native courts to deal with purely native matters.

History. Portuguese navigators first rounded the southern tip of the African continent in 1488, and trade with the Orient was established before 1500. In 1652 the Dutch East India Company established an outpost at the Cape of Good Hope to provide supplies for company ships voyaging between Europe and the East Indies. Soon afterward Dutch colonists began to settle in the area that is now Cape Town, and in 1688 a number of Huguenots, driven from France by religious persecution, emigrated to South Africa.

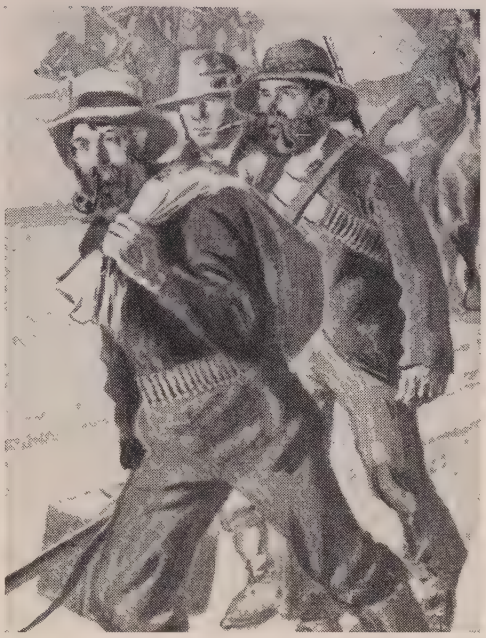
The Europeans slowly pushed into the interior. The Bushmen and Hottentots in the western part of the Cape did not resist the white men so fiercely as did the Bantu natives in the central and eastern regions, who came into conflict with the whites in the early nineteenth century, but the pioneer farmers had to fight for their lands. The Boers were hardy, independent people, and they kept on into the grasslands of the veld in spite of all obstacles.

British troops took possession of the Cape in 1795 at the request of the Prince of Orange, who was afraid that Napoleon might take over the colony. From 1803 to 1806 South Africa was nominally Dutch, but when Napoleon again conquered the Netherlands, the British resumed control of the Cape. They were given the colony when peace was made in 1814.

British colonists settled in Natal and in the Cape after 1820, and with their arrival came a trend toward representative government. There was also increasing criticism of the system of slave labor on which many Boers had come to depend. Slavery was abolished in 1834, and differences between the British and some of the Boers led to the Great Trek two years later, when about two thousand Dutch families loaded their possessions into oxcarts and moved into the unoccupied lands of the interior. Gradually two independent Boer republics grew up, the South African Republic, in the Transvaal, and the Orange Free State. The British recognized their independence in the 1850's.

Diamonds were discovered near Hopetown, in the Cape Colony, in 1867, and in 1871 the rich deposits near Kimberley were found. This mineral wealth drew many new settlers into the border country between the British colonies and the Dutch republics, and friction increased. The British annexed the South African Republic in 1877, but four years later the Boers revolted and forced them out.

The discovery of gold in the Witwatersrand in 1886 brought a flood of fortune seekers into the Transvaal. In the Cape Colony, Prime Minister Cecil Rhodes, a leader of the industrialists and business interests, wanted complete development and exploitation of South Africa as a whole. Highways and railroads were built; corporations were organized; and the demand for federation of the four territories — two British and two Dutch — increased.


The Bettmann Archive

BOER FARMERS LEFT THEIR HOMES to wage war against the mighty British army.

The Boers, who were conservative, independent agricultural people, were suspicious of the British, who were city people, interested in the development of industry, and somewhat more liberal in their political ideas. Both sides had reason for grievances, and in 1899 war broke out. It ended, after a bitter struggle that lasted for more than two years, with the annexation of the two Dutch states by the British. The Boer states were granted constitutions and self-government in 1906, and two years later the four colonies decided to form a union. The Union of South Africa came into being in 1910 with dominion status; its full sovereign independence was recognized in the Statute of Westminster in 1931.

In spite of the long-held antagonisms between many of the Boers and the British, the Union gave active support to Great Britain and the Allies in 1914 and in 1939, and became a charter member of the United Nations. The three most prominent statesmen of the country have been Boers: Botha, the first Prime Minister; Hertzog, the leader of the Nationalists in the period between the two World Wars; and Smuts, who played a major part in international affairs for many years. After the Second World War there was still some strong feeling among the Boer Nationalists for complete separation from the British Commonwealth of Nations and the establishment of a republic.

Related Articles. Consult the following titles for additional information:

Boer War
Cape of Good Hope

Cape-to-Cairo Railway
Cape Town
Durban
Johannesburg
Kimberley
Kruger, Stephanus
Natal
Orange Free State
Orange River
Pretoria
Smuts, Jan Christian
Transvaal

UNION OF SOVIET SOCIALIST REPUBLICS. See Russia.

UNIT, a member of an aggregate, or group of like things; a single thing regarded as an undivided whole. In arithmetic the term denotes the smallest whole number, which is called *one,* or *unity,* and is represented by the figure 1. In the chemical industries and in many factories the physical operations involved are broken down into so-called unit *operations* like crushing, crystallization, evaporation, and mixing, any one of which always requires essentially the same kind of equipment and has the same theoretical basis. Chemical procedures are likewise broken down into unit *processes* such as double decomposition, oxidation, and reduction. Businessmen speak of the number of units (stores) in a drug, grocery, or dry-goods chain; manufacturers of unit costs of manufactured items; and biologists of unit characters, or traits, of organisms that are transmitted unchanged from one generation to the next. Military and naval units are such varied ones as a squad, a regiment, or a fleet.

In commerce and the sciences the amount of any physical quantity is expressed in terms of a unit, or unit *measure,* which is another quantity of the same kind. Thus an acre is a unit for measuring area and a ton is a unit for measuring weight (see tables under Measures).

System of Units. In physics it is customary to choose a set of *fundamental* units from which all other physical units can be derived. The *foot* of length, the *pound* of mass, and the *second* of time are the fundamental units in the English *f.p.s.* system. Among the *derived* units of this system are the speed unit, the *foot per second;* the density unit, the *pound per cubic foot;* and the force unit, the *poundal.*

In the metric *c.g.s.* system the fundamental units are the *centimeter* of length, the *gram* of mass, and the *second.* Some of the derived units are the *gram per square centimeter,* a unit of pressure; the *dyne,* a unit of force; and the *erg,* or *dyne-centimeter,* a unit of work. The metric *m.k.s.* (meter-kilogram-second) system has the advantage that most of its units are more convenient in size for everyday use than the corresponding c.g.s. units, and its electrical units are the ordinary practical units such as the volt, ampere, and watt.

In the English gravitational, or engineering, system the fundamental units are the foot, second, and the pound of *force* (*not* pound of mass). The unit of mass in this system is a derived unit called the *slug.* The pound of force is 32 times the poundal, and the slug of mass is 32 times the pound of mass. See Mass (in physics).

UNITAR'IANS, believers in the one God, rather than in the Trinity of God, Son, and Holy Ghost. The name usually refers to the members of one Protestant denomination, but broadly defined it includes many persons in other Christian churches. Unitarianism is liberal Christianity, which is based on human reason and modern science and is devoted to individual liberty and universal tolerance. The movement began in the sixteenth century as a phase of the Reformation. For several centuries members of this liberal movement, called Socinianism after the Italian leader, Faustus Socinus, were persecuted by both Catholics and Protestants.

Refugees from the Continent introduced Socinianism into England early in the seventeenth century. After a long period of persecution it finally gained legal toleration in 1813. In New England, Unitarianism appeared during the eighteenth century. Under the leadership of William Ellery Channing some 120 Congregational churches formed the American Unitarian Association in 1825. The International Association for Liberal Christianity and Religious Freedom was organized in 1900 to represent groups in some thirty countries. Unitarianism has never gained large numbers, but it has had considerable influence because of its appeal to intellectuals, liberals, and reformers.

The Unitarians have no creed, but they believe in a benevolent God. They regard Jesus not as divine but as a man who was fully obedient to the will of God. They prize the Bible as the literary record of spiritual experience, but they insist it must be interpreted in the light of science and learning. The Unitarians in the United States number about 70,000. There is a movement under way for the merger of the Unitarians and the Universalists.

UNITED CHURCH OF CANADA, the largest Protestant denomination in Canada, was formed in 1925 by the union of the Methodists, Congregationalists, and most of the Presbyterians. Originally each of these three groups was split into many divisions, but about 1860 there began a movement for church union. Numerous mergers took place among the Presbyterians until 1875, when all were joined in one Canadian denomination; Methodist union proceeded in the same manner and was completed in 1884. Discussions then began for a larger union but the final step was not taken until 1925. The new Church included all the Methodists and Congregationalists, but nearly half of the Presbyterians remained with the old denomination.

The United Church of Canada was the first large-scale union of Protestant denominations since the Reformation. Moreover, it has opened discussions for union with the Church of England in Canada and with other groups. It is a member of the Canadian Council of Churches and of the World Council of Churches. Its supreme governing body is the biennial General Council and its highest official is the moderator who is elected for a two-year term. The Church maintains missions in many foreign lands. The membership of the United Church is slightly more than 800,000, but it has the pastoral care of about one fifth of the people of Canada.

UNITED DAUGHTERS OF THE CONFEDERACY. See CONFEDERACY, UNITED DAUGHTERS OF THE.

UNITED EMPIRE LOYALISTS, inhabitants of the American colonies who remained loyal to Great Britain during the American Revolutionary War. The name was given particularly to those Loyalists who made new homes in Canada after the war. Many of the colonies seized any property belonging to people who supported the British side, and some Loyalists were roughly handled. Because of the bitterness that remained after peace was made, many left the country in 1783 and 1784. About 35,000 Loyalists migrated to Nova Scotia, especially to the region that became New Brunswick. A smaller number went into Quebec, and many settled in Upper Canada, which is now Ontario. Many of these people were well-to-do, well educated, and able, and they contributed much to the development of Canada.

UNITED KINGDOM, the name of the country formed by the union of England, Scotland, Wales, and Northern Ireland. Wales was conquered by the English in the fifteenth century, and England united with Scotland in 1707 to form Great Britain. When Ireland was taken into the union in 1801, the name adopted was the United Kingdom of Great Britain and Ireland. Southern Ireland won virtual independence in 1922 as the Irish Free State, and the formal title of the kingdom was altered to the United Kingdom of Great Britain and Northern Ireland. Parliament approved the change in 1927. See also GREAT BRITAIN; IRELAND.

UNITED MINE WORKERS OF AMERICA, an industrial union of coal workers, first organized in 1890. John L. Lewis became its president in 1920. It was originally a unit of the American Federation of Labor, but with several other industrial unions it was expelled from the AFL in 1936 and with them organized the Congress of Industrial Organizations in 1938. The Mine Workers left the CIO in 1942, rejoined the AFL in 1946, and again became an independent union in 1947. The UMW includes in its membership workers in and around the coal mines and certain other workers in affiliated industries. The union has been involved in many national strikes. Its first strong leader was John Mitchell, who was UMW president from 1898 to 1908. He directed the great anthracite strike of 1902, which the miners won when President Theodore Roosevelt forced the owners to arbitrate the issues. Later strikes won the eight-hour day, union recognition by the coal operators, and better working conditions. John L. Lewis, who led his union repeatedly through strikes, even in wartime, won the men better wages and working conditions, pensions, medical care, and death benefits. The UMW has a membership of about 600,000. See also LEWIS, JOHN L.

UNITED NATIONS. See NATIONS, UNITED.

UNITED NATIONS EDUCATIONAL, SCIENTIFIC, AND CULTURAL ORGANIZATION (UNESCO). See NATIONS, UNITED.

UNITED NATIONS RELIEF AND REHABILITATION ADMINISTRATION (UNRRA). See NATIONS, UNITED.

UNITED SERVICE ORGANIZATIONS (USO), an association formed in 1942 by several social agencies interested in providing entertainment and assistance to members of the armed forces and their families. The Young Men's Christian Association, the Young Women's Christian Association, the National Catholic Community Service, the Salvation Army, the Jewish Welfare Board, and the National Travelers Aid Association joined together in a program of services to the men and women in uniform. The USO established clubs for servicemen in many cities and towns, arranged entertainments at army camps and USO centers, sent shows overseas to military areas, set up information bureaus in railroad stations, and gave help to many servicemen and their families. The USO was disbanded at the end of 1947, but it was revived temporarily in 1949, and in 1951 it began to operate as it had during the war. A seventh agency, called Camp Shows, Inc., was added to the original six. The USO received contributions of about $200,000,000 during the war years and used about a million volunteer workers.

UNITED STATES CAPITALS. See CAPITALS OF THE UNITED STATES.

UNITED STATES COAST GUARD. See COAST GUARD, UNITED STATES.

UNITED STATES CONSTITUTION. See CONSTITUTION OF THE UNITED STATES.

UNITED STATES MILITARY ACADEMY. See MILITARY ACADEMY, UNITED STATES.

UNITED STATES NAVAL ACADEMY. See NAVAL ACADEMY, UNITED STATES.

UNITED STATES OF AMERICA

UNITED STATES OF AMERICA, a federal republic composed of forty-eight states and the District of Columbia, situated in the central part of the continent of North America. It is a giant among the nations, and it is also a world power. Within the present century its vast wealth and productive capacity have so increased its prestige that in its influence on international affairs it surpasses much older nations.

Geographically the United States is one of the most favored regions of the world. It lies wholly within the north temperate zone, and a large part of the country has a healthful and invigorating climate. Its physical resources are so varied and so plentiful that, combined with machine production, they have made it one of the foremost agricultural and industrial nations; also there are no trade barriers between states or between regions, and the free flow of goods creates markets and makes mass production possible at lower cost. Although each section of the country has its distinctive attitudes, way of life, and manner of speech, there exists throughout the nation a strong feeling of national unity. It is the co-operation of the American people in thus working together that has made their land a sovereign nation of federated states.

Location and Area. The American Republic is a broad, almost rectangular country with an area of 3,022,387 square miles. It is often called the continental United States, because it is the mainland from which are governed several outlying dependencies. Among these dependencies are the vast Organized Territory of Alaska and the chain of Pacific islands constituting the Territory of Hawaii. Smaller dependencies include Puerto Rico, Guam, American Samoa, the Panama Canal Zone, and the Virgin Islands of the United States. Although the Republic of the Philippines gained its independence in 1946, the United States has increased its Pacific holdings by taking over, as trust territories for the United Nations, the former Japanese-held Marianas, Caroline, and Marshall islands. Including these possessions, which have a combined area of 598,103 square miles, the United States controls a total land and inland-water area of 3,620,490 square miles.

Continental United States borders on the world's two largest oceans, the Atlantic to the east and the Pacific to the west, and it touches on the southeast the Gulf of Mexico, an arm of the Atlantic. It shares its open, unfortified land boundaries with two friendly nations — Canada to the north and Mexico to the south. The eastern half of the northern boundary is formed mostly by four of the Great Lakes — Superior, Huron, Erie, and Ontario — and by the St. Lawrence River, which links these lakes with the Atlantic. The remainder of the northern boundary lies to the west of the lakes along the historic forty-ninth parallel of north latitude (see OREGON, *History*). A large portion of the southern boundary is formed by the Rio Grande, which the United States has controlled jointly with Mexico since the close of the Mexican War in 1848.

Surface Features

The United States comprises five physical regions which differ in climate, altitude, land forms, soil, water power, mineral resources, and plant and animal life. These differences have resulted in the development of social and economic systems especially adapted to the prevailing geographic conditions. The specialized economies have varied from the plantation system of the South to the factory system of the North, from the mining of the Mountain West to the wide-scale lumbering of the Far West. Sharp divisions no longer exist, however, and the trend is toward greater uniformity. The five physical regions are known as the Atlantic and Gulf Coastal Plain, the Appalachian Highlands, the Interior Plains, the Rocky Mountains and Intermountain Plateaus, and the Pacific Highlands and Lowlands.

Atlantic and Gulf Coastal Plain. The easternmost physical region is the Atlantic and Gulf Coastal Plain, which covers nearly one tenth of the total area of the United States. Narrow in the north and wide in the south, this comparatively level area extends from southern Maine to Florida and thence along the Gulf of Mexico to eastern Texas. In the north the coast is irregular, with arms of land like Cape Cod, Cape May, Cape Fear, and Cape Hatteras reaching out into the Atlantic. Here, too, are many fine harbors, on which, in colonial times, Boston, Providence, New York, Baltimore, and other port cities were built. Most of the coastal cities stand at the mouths of rivers which were once used as lines of communication to inland areas. Inland on the coastal plain, Washington, Philadelphia, Trenton, and scores of industrial centers grew up on the Fall Line, where streams drop to the gradually rising sand-and-clay plain from the hard-rock Piedmont Upland and the New England extensions of the Appalachian Highlands. The Fall Line extends from Portland, Me., in the north to Columbus, Ga., in the south. Since the earliest days of the Industrial Revolution the falls and rapids formed here have furnished water power to turn the wheels of industry for many American towns and cities.

To the south the coastal plain widens, and from the Gulf of Mexico it extends as far inland as southern Illinois. At the southern end of the plain is the delta of the mighty Mississippi River. Other rivers drain the coastal plain to the east and west of the Mississippi. Much of the southern section of the plain was once under the ocean; fertilized and cultivated, the stretch of sandy soil became famous as the Cotton Belt. Great cities grew up along the southern coast all the way from Norfolk, Va., to Galveston, Tex. Inland the raising of cotton and tobacco developed such distribution centers as Memphis, Louisville, and Raleigh. Florida's winter resorts balance the seaside summer resorts of New England.

Appalachian Highlands. In colonial times the hill-and-mountain region of the Appalachians formed a natural barrier to settlement west of the Atlantic Coastal Plain. Most of the region is a low plateau, from 1,000 to 3,000 feet above sea level, crossed in a generally northeast to southwest direction by a number of mountain groups and ranges. In the north are the Highlands of Maine, the Green Mountains of Vermont, the White Mountains of New Hampshire, and the Adirondack Mountains of New York. Hundreds of scenic lakes have made the region a superb vacation land. Among the larger lakes are Moosehead in Maine, Winnipesaukee in New Hampshire, and Champlain and George in eastern New York.

South of the Mohawk Valley and the Finger Lakes section of New York the Appalachian Highlands are divided into four districts. Farthest east is the rolling, hilly Piedmont Upland, extending from New Jersey to Georgia. It is paralleled to the west by the Blue Ridge district, stretching from New York's Highlands of the Hudson to the Cohutta Mountains of northwestern Georgia. Within this district are the Shenandoah and Great Smoky Mountains national parks. West of the Blue Ridge is the Ridge and Valley district, consisting of a series of parallel heights and depressions which extend from the St. Lawrence Valley through the Hudson, Delaware, and Shenandoah valleys to the Tennessee Valley; this region as a whole is known as the Great Appalachian Valley. The Appalachian Plateaus, forming the westernmost district, are crossed by the Catskill Mountains of New York, the Alleghenies of Pennsylvania and West Virginia, and the Cumberland Mountains of Kentucky and Tennessee.

Many rivers rise in the Appalachians, and Mount Mitchell (6,684 ft.) in the Black Mountains of North Carolina is the highest point east of the Mississippi. The raw materials and power resources of the region are used in such industrial centers as Pittsburgh and Scranton, Pa., Wheeling, W. Va., Knoxville and Chattanooga, Tenn., Atlanta, Ga., and Birmingham, Ala.

Interior Plains. Much of the interior of the United States — the Central Plain — is level or gently rolling prairie, stretching from the Appalachian Plateaus in the east to a similar upland section in the west — the Great Plains. The Central Plain is not all lowland, however. In the north is the Superior Upland of Minnesota, Wisconsin, and Michigan, an extension of the Laurentian, or Canadian, Shield north of the Great Lakes. Farther south there are plateau and mountain areas in Indiana, Kentucky, and Tennessee. In Missouri, Arkansas, and Oklahoma are the Ozark and Ouachita mountains.

The Mississippi and its larger tributaries give the Central Plain one of the finest drainage systems in the world. In the north, where glaciers spread during the Ice Age, small lakes are numerous, and in the east are Mammoth Cave and other limestone caverns. The fertile soil and adequate rainfall of the Central Plain have made it an outstanding grain-producing area. It is divided into the spring-wheat belt of Minnesota and the Dakotas, the dairy and hay belt of Wisconsin and Michigan, and the corn and winter-wheat belt extending from Ohio through Illinois and Iowa to Nebraska and Kansas.

In the west the Central Plain merges with the gradually rising, nearly treeless Great Plains. The Missouri River Plateau, with its isolated steep hills, or buttes, lies at the northern end of the Great Plains. At the southern end is a grass-covered plateau — the Llano Estacado (or Staked Plain) of western Texas and southeastern New Mexico. In western South Dakota are the Black Hills, famous for their scenic beauty and mineral resources. Because rainfall is light, the Great Plains region is devoted chiefly to dry farming and grazing.

The Interior Plains region as a whole has industrial importance as well as agricultural value. Within its limits are located the huge industrial centers of the Great Lakes area, where steel, farm machinery, automobiles, rubber goods, and furniture are produced; the flour mills of Minnesota, the petroleum refineries of Oklahoma, the meat-packing houses of Illinois, Nebraska, and Kansas; and hundreds of other processing and manufacturing hubs.

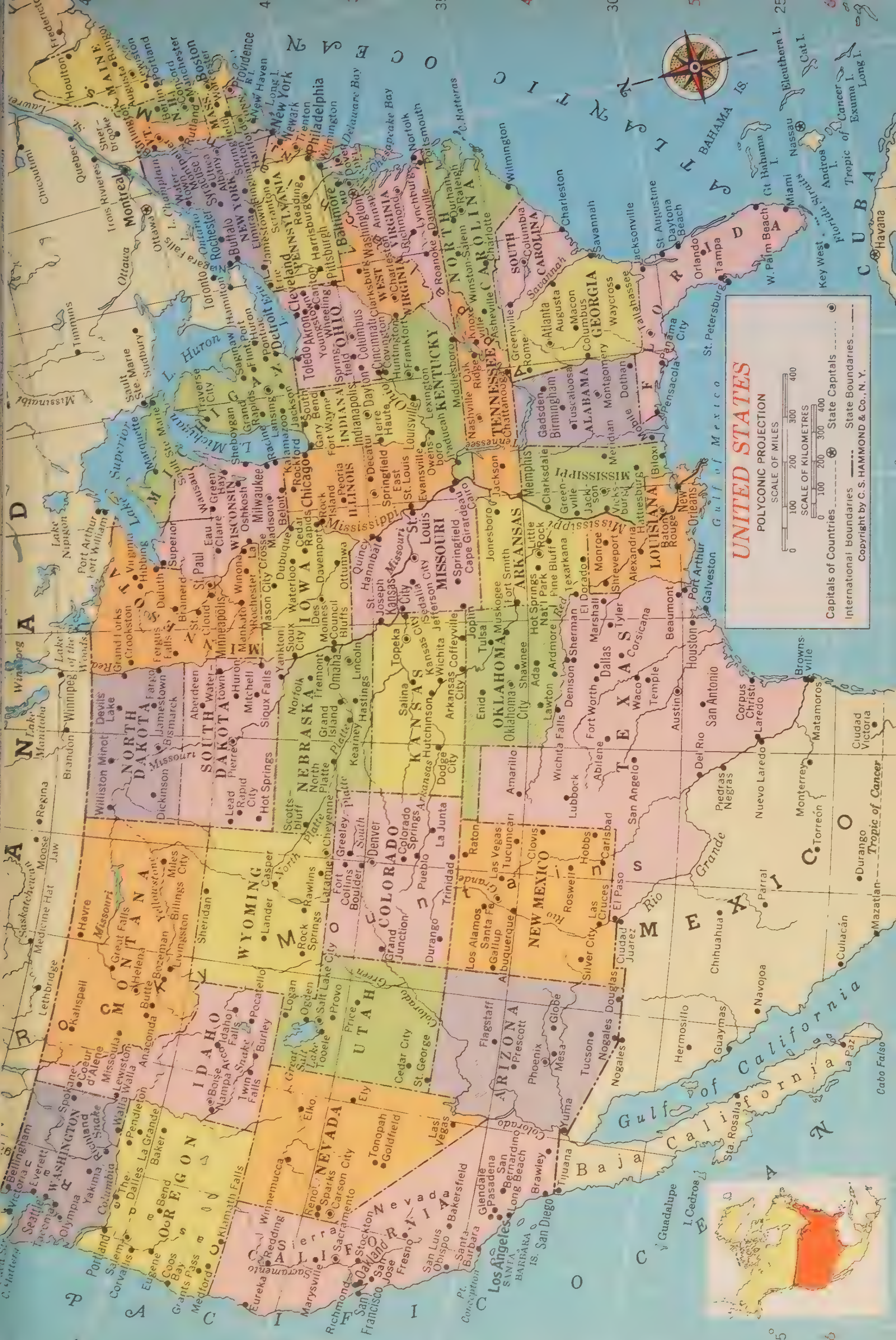
Rocky Mountains and Intermountain Plateaus. The Rocky Mountains and the plateaus that lie between the mountains and the Pacific Highlands cover nearly one fourth of the entire area of the United States. The Rockies, forming the backbone of the region, contain rich deposits of gold, silver, copper, lead, zinc, and other minerals that have attracted prospectors and settlers to the West for many decades. Divided into the Northern and the Southern Rockies by the high plain called the Wyoming Basin, the mountain system extends all the way from the Bitterroot Range along the Idaho-Montana boundary to the Sangre de Cristo Mountains of northern New Mexico.

The Northern Rockies are famed both for majestic peaks and glacier-fed lakes and for the hot springs, geysers, and other natural wonders of the Yellowstone Park area. Even loftier peaks are found in the Southern Rockies. Throughout the Rocky Mountain section the crest of the highest ridges forms the Continental Divide, a watershed for streams flowing west to the Pacific and east to the Gulf of Mexico.

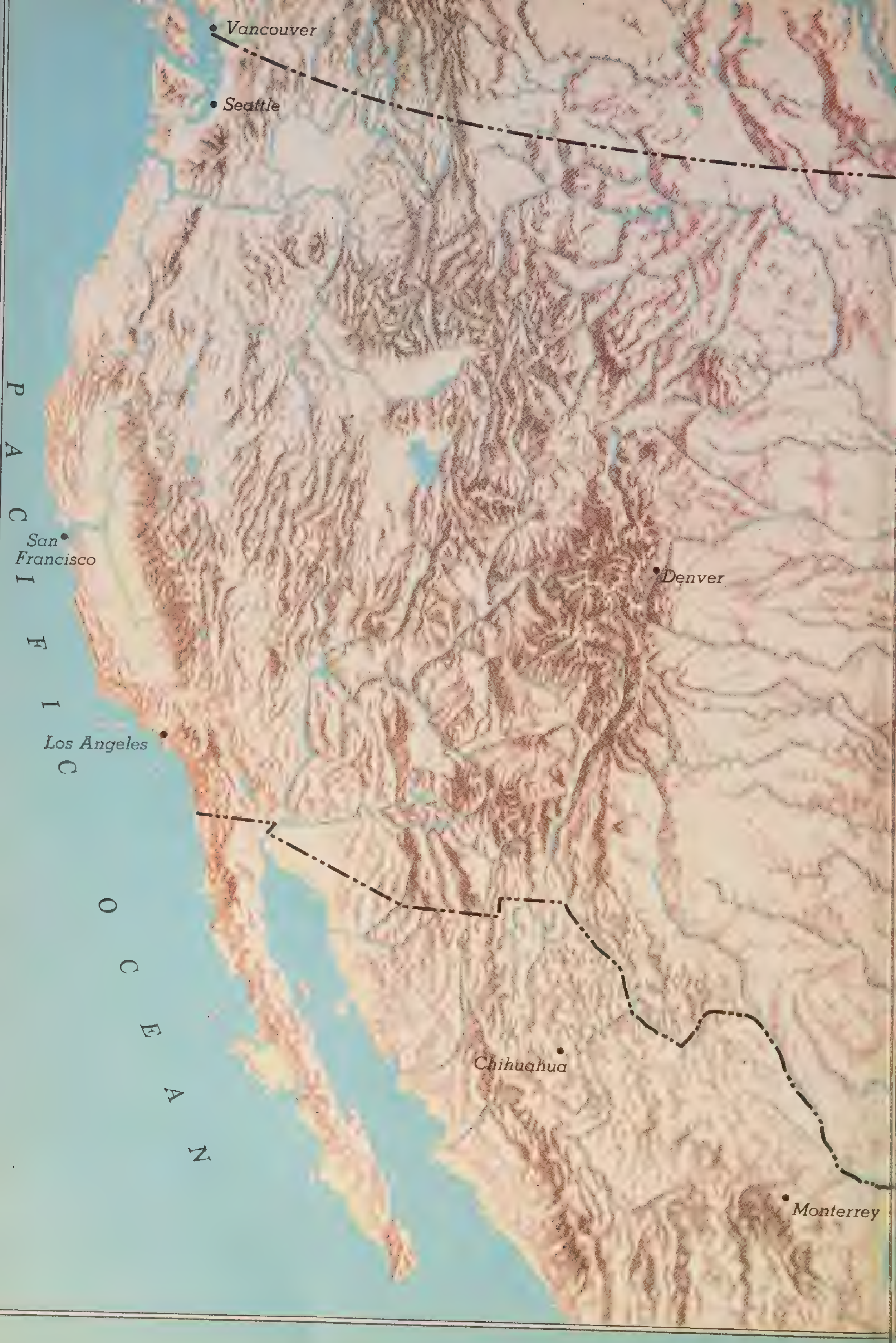
The Intermountain Province consists of three divisions. In the north is the Columbia Plateau, a lava-covered tableland in eastern Washington and Oregon and central Idaho, which is crossed by the Blue Mountains and the Columbia River. The second district, the Basin and Range, extends southward from Oregon and Idaho to the Mexican border of Arizona and New Mexico. In this district are the Wasatch and Sacramento mountains and the Great Basin, a vast, semiarid region in Nevada and western Utah. Here, also, are Great Salt Lake and Badwater, a salt pool in Death Valley, California, the lowest point in the United States. The third district, the Colorado Plateau, occupies western Colorado, eastern Utah, northern Arizona, and northwestern New Mexico, and is drained by the Colorado River and its tributaries. The Grand Canyon, Bryce Canyon, Zion National Park, and Monument Valley are among the scenic wonders of this area.

Because the rainfall is very scant, the Intermountain Province is the most extensively irrigated section of the United States. Dry farming and grazing are most common here. By storing and distributing water, huge dams on the rivers of the district have helped to reclaim semiarid sections; and by providing hydroelectric power, these same dams have made possible the rise of busy industrial centers, such as Spokane, Wash. Many other cities, including Butte, Mont., Salt Lake City, Utah, and Denver, Colo., owe their development to nearby mineral resources. A number of health and vacation resorts are located in the region.

Pacific Highlands and Lowlands. The westernmost region of the United States is the valley-and-range area along the Pacific coast. Offering many contrasts, it is noted both for the subtropical fruits of southern California and for the evergreen forests which flourish under the heavy rains of western Washington and Oregon. The highest point in the United States is Mount Whitney (14,495 ft.) in the Sierra Nevada of California, a range which continues to the north as the Cascade Mountains of Oregon and Washington. Between the lofty



Larger-scale maps of the American states appear with the article STATE.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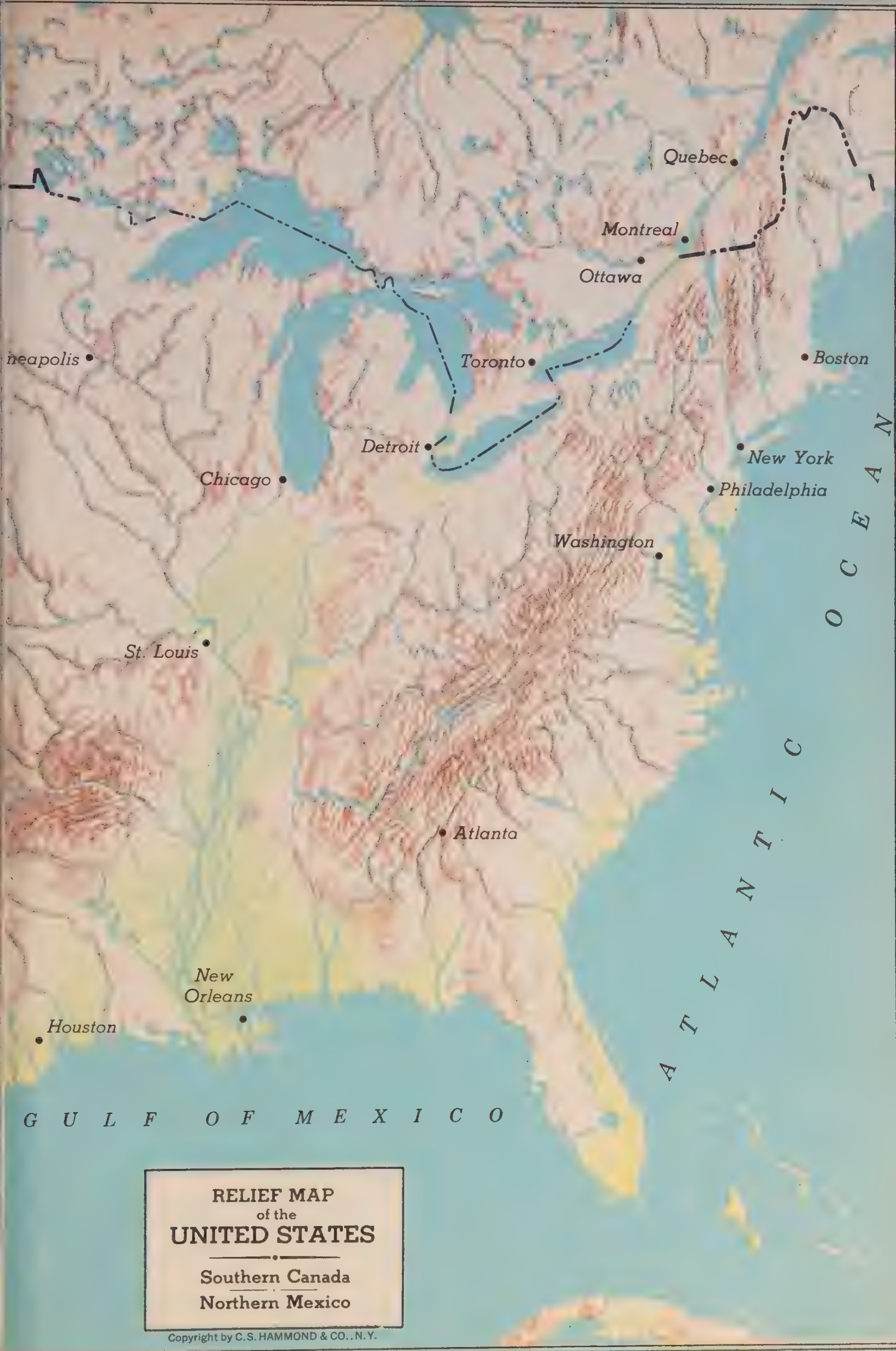

RELIEF MAP
of the
UNITED STATES

Southern Canada
Northern Mexico

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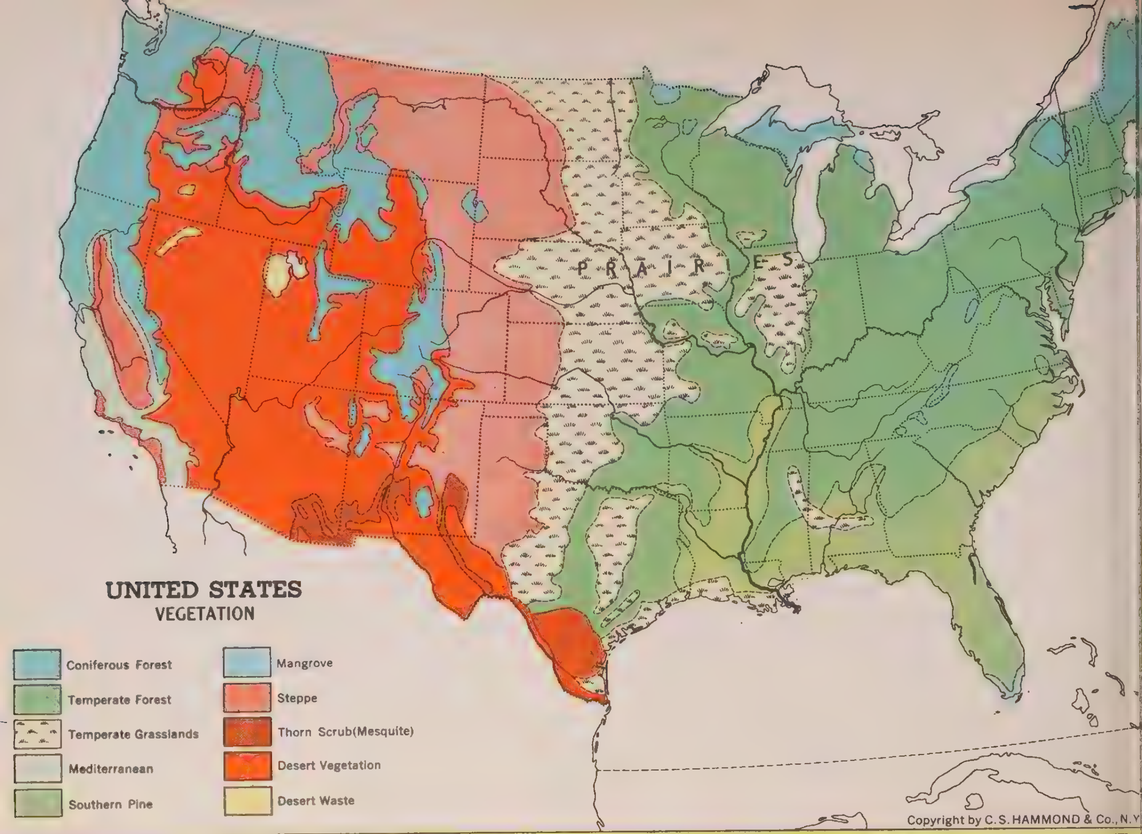

UNITED STATES
VEGETATION

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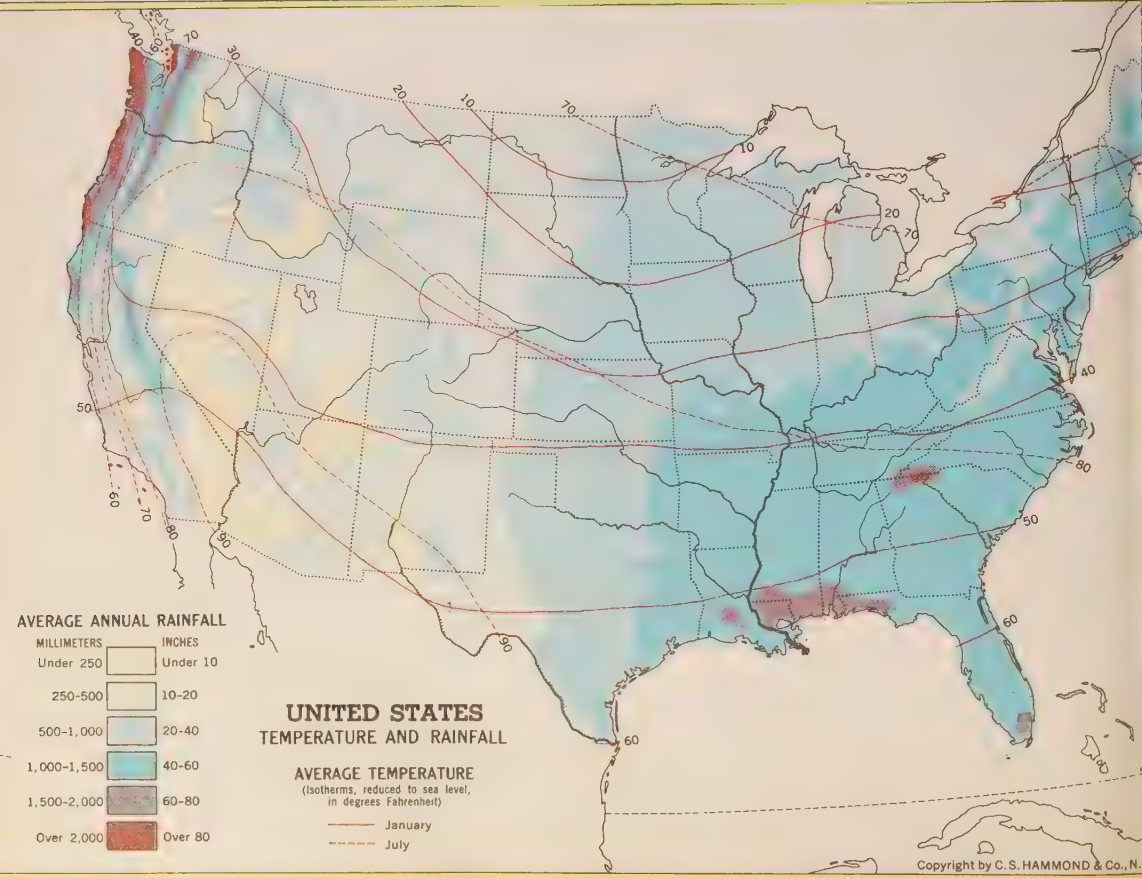

UNITED STATES
TEMPERATURE AND RAINFALL

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Sierras and the low Coast Ranges to the west, the land dips in Washington's Puget Sound Trough, Oregon's Willamette Valley, and California's Central Valley. The lowlands farthest south are the Imperial Valley of southeastern California and the Los Angeles basin, a widening of the narrow Pacific coastal plain.

Although the Columbia and the Sacramento are the only long rivers of the Pacific region, many streams are valuable for irrigation and hydroelectric power. The chief ports on the Pacific coast are Seattle and Tacoma on Puget Sound, San Francisco and Oakland on San Francisco Bay, and Los Angeles on San Pedro Bay. In general the Pacific coast is much more regular than the Atlantic coast. The numerous vacation lands range from seaside summer resorts in southern California to centers for winter sports in the forested mountains of Washington.

NYSPIX-Commerce

THE TOWERING SKYSCRAPERS OF NEW YORK CITY greet new arrivals to America from across the Atlantic. In the foreground is famous old Brooklyn Bridge.

Climate

Variations. Because of the range of latitude, the climate of the United States varies greatly. The northernmost point, on Lake of the Woods, Minn., has the same latitude (49°20′N.lat.) as southern Siberia, while the southernmost point, near Cape Sable, Fla., has the same latitude (25°7′N.) as a part of the Sahara. There are other conditions, too, that cause variations. The climate is milder along the coasts and around the Great Lakes than it is in many regions farther inland, for the great bodies of water moderate the summer heat and the winter cold. The warm Gulf Stream is responsible for Florida's mild winters. High plateau and mountain areas are generally cooler than lowlands. Mountains may also act as barriers to rainfall, causing rain to fall heavily on the side of the range facing the moisture-bearing winds and turning the land on the other side of the range into a desert.

Americans can sample every kind of temperate-zone climate by traveling around their country. They can experience cold, brisk winters in New England; blizzards in northern sections of the Great Plains; mild, rainy winters in the Pacific Northwest; long, sunny days in southern California; warm, dry air in the Southwest; clear, cold air in the Rockies; hot summers in the Middle West; and months of warm, damp weather along the southern Atlantic coast and around the Gulf of Mexico.

Climatic Regions. The largest region of the United States according to divisions by types of climate is called the *Humid Continental.* It covers the northern part of the Atlantic Coastal Plain, the Appalachian Highlands, and the Central Plain section of the Interior Plains. Thus it extends all the way from the eastern seaboard to a point west of the Mississippi. In general the winters are long and cold and the summers mild in the north, while the seasons are more evenly balanced and the summers hot in the south. Rainfall and snowfall (called precipitation) are heaviest along the coast and in the Appalachian Highlands, averaging 40 to 60 inches a year. This precipitation occurs when warm, moist air from warm sections of the Atlantic meets dry, cold air from cold sections of the Atlantic or from northern Canada. The coldest winters and hottest summers are those of the Central Plain, which is exposed to freezing winds from the far north and hot, dry winds from Mexico and Texas. Over most of the Central Plain the precipitation amounts to only 30 or 40 inches a year.

The southern part of the Atlantic Coastal Plain and all of the Gulf Coastal Plain are in a climatic division called the *Humid Subtropical Region.* Here rains are heavy, reaching as high as 80 inches a year in the Mississippi delta. Heaviest in the long, hot, summer season, they have produced a forest zone extending from Georgia to eastern Texas and have made the Gulf Coastal Plain one of the most productive farming sections of the United States. Winters are generally mild. The tip of Florida, visited in summer by rain-bearing southwest winds of the tropical Atlantic, is included in the *Monsoon Tropical Region,* where summers are long and hot and frosts are very rare. Violent storms called hurricanes sometimes strike this area in late summer and fall.

The northern part of the Great Plains section and the Rocky Mountain and Intermountain Plateau Region fall into the *Dry Continental* climate division. Here summers are brief and winters long and cold. Heavy snows fall in the mountains. Because the Coast, Cascade, and Rocky Mountain ranges rob the winds from the Pacific of their moisture, the plains and plateaus in this area have an annual rainfall of barely 10 to 20 inches. Although precipitation is less and temperatures are higher, the situation is generally similar in the *Dry Subtropical Region* to the south; here the rains fall on the western slopes of the Sierra Nevada and scarcely reach areas east of the mountains. Moisture in much of Colorado and New Mexico comes from mountain snows, which melt to feed countless rivers and provide water for irrigation. Driest of all is the *Arid Tropical Region* of western Nevada, southeastern California, and western Arizona, which receives less than 10 inches of rain a year. Summers here are very long and very hot; winters are brief and mild.

The northern part of the Pacific region has a *Temperate Marine* climate. The ocean has a moderating effect on the temperature, producing cool summers and mild winters. Winds from the Pacific bring a great amount of moisture, especially during the winter months. Along the coasts of Washington and Oregon the precipitation totals 80 inches or more a year; inland it varies from 40 to 60 inches in the valleys between the Coast and Cascade ranges and from 20 to 40 inches in the area just east of the Cascades.

California, in the southern part of the Pacific region, has what is called a *Mediterranean Subtropical* climate, similar to that of countries along the Mediterranean Sea. Winters are cool and rainy, summers rather hot and dry. Rainfall varies from 40 to 60 inches in the north to 10 to 20 inches in the southern area close to the Arid Tropical Region. All along the Pacific coast the California Current, an offshoot of the Japan Current, modifies the temperature.

Plant and Animal Life

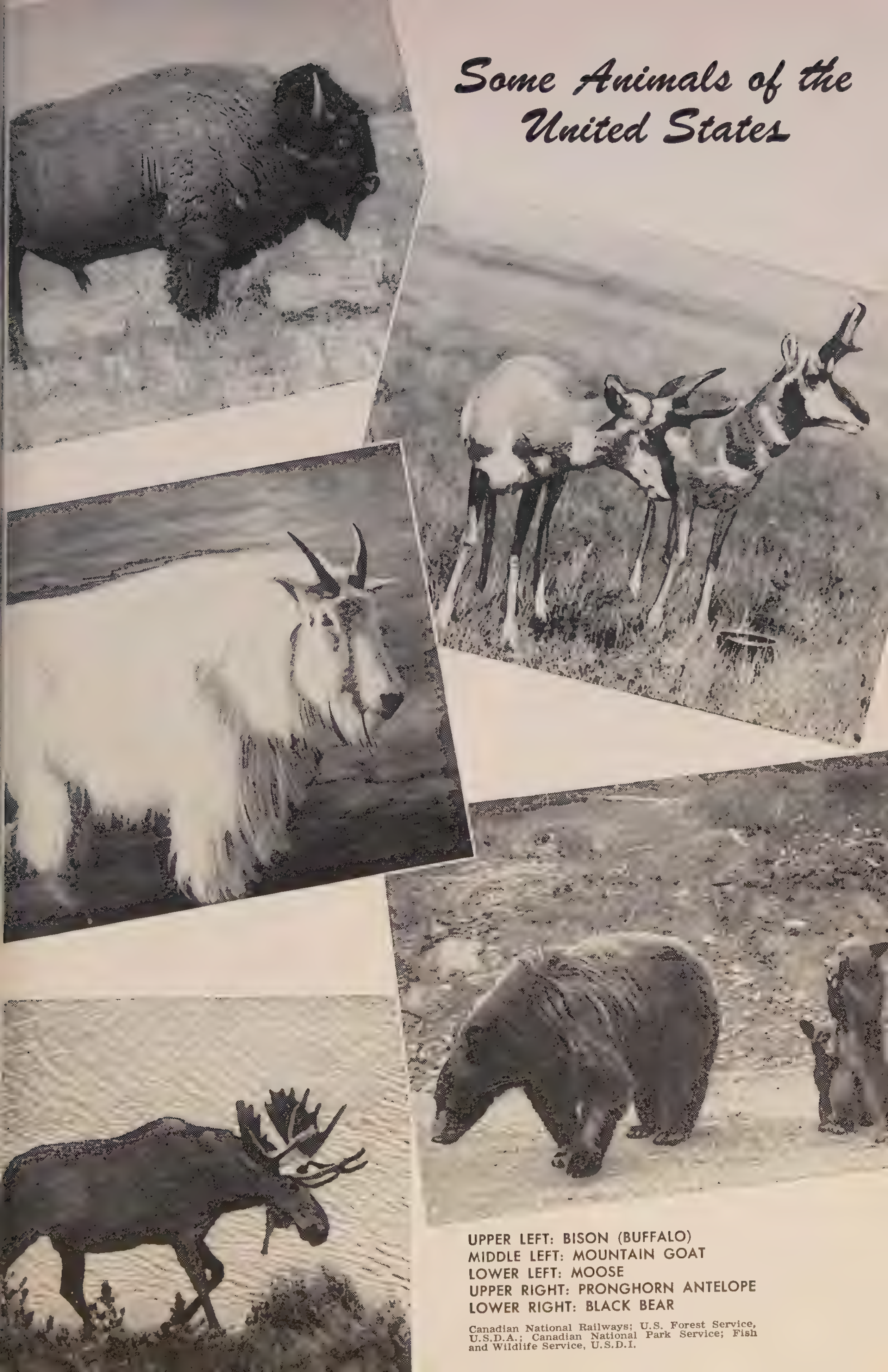
Landscape Features. The diversity of its climate and land forms gives the United States three natural landscape regions — forest, grassland, and desert. They are subdivided into districts which contain a greater variety of plant types than are found in any other part of the north temperate zone. They also afford a home for thousands of species of animals that, like the plants, have had to adapt themselves to particular conditions of moisture, temperature, and food supply and in some cases have been able to adapt themselves to all three regions.

The forest region is the most extensive, though today much of it has been cleared of trees and little of the original virgin forest remains. The amount of grassland used for grazing has also been steadily reduced ever since the early nineteenth century, when the invention of the steel plow and reaper enabled farmers to cultivate more and more of the grassland region. Even the desert region is slowly being reclaimed for settlement through the construction of irrigation and power-plant dams.

Eastern Forests. The northernmost of the eastern forest districts is the *Northern Coniferous Forest,* which extends westward from Maine to Minnesota and as far south as northern Pennsylvania. It is called coniferous because it is rich in cone-bearing trees like pines, firs, and spruces. In the spring the ground beneath these trees is carpeted with mosses, ferns, and small flowering plants, such as the arbutus, trillium, and lady's-slipper. The dense evergreen forest has long been the home of the porcupine, moose, and white-tailed deer, which once provided food and clothing for the Indians and early colonists and are today hunted by sportsmen during open seasons.

To the south of the Great Lakes the Northern Coniferous Forest merges with a "deciduous" forest — that is, one whose trees shed their leaves before the cold winter season. This forest is called the *Central Hardwoods Forest,* since it extends as far south as northern Georgia and as far west as eastern Oklahoma and Texas. It is seen at its best at such places in the Appalachians as the Great Smoky Mountains. These mountains are a mass of flaming reds and yellows when the leaves of the maple, oak, and hickory and the beech, ash, and birch begin to turn. The

Some Animals of the United States



UPPER LEFT: BISON (BUFFALO)
MIDDLE LEFT: MOUNTAIN GOAT
LOWER LEFT: MOOSE
UPPER RIGHT: PRONGHORN ANTELOPE
LOWER RIGHT: BLACK BEAR

Canadian National Railways; U.S. Forest Service, U.S.D.A.; Canadian National Park Service; Fish and Wildlife Service, U.S.D.I.

Some Plants of the United States

UPPER LEFT: SAGUARO CACTUS
MIDDLE LEFT: CRANBERRIES
LOWER LEFT: GREAT LAUREL
UPPER RIGHT: JOSHUA TREE
MIDDLE RIGHT: PUMPKINS
LOWER RIGHT: CABBAGE PALMS

Botanical Museum, Harvard University; Florida News and Photo Service; Standard Oil Company (N.J.); U.S.D.A.; Santa Fe Railway.

azalea, rhododendron, dogwood, mountain laurel, and other flowering shrubs grow in the deciduous forest area. The forest shelters countless song and game birds, numerous snakes, and small mammals such as the shrew, skunk, and squirrel.

The *Southern Pines Forest* is a district extending from the Pine Barrens of New Jersey to the stands of longleaf, loblolly, and slash pine in Georgia and Alabama. Economically it is one of the most important districts, for its pine trees not only yield resin and turpentine but are the source of the wood pulp used in making newsprint and wrapping paper. On the flood plains of the Mississippi and in the swampy areas along the southern coastal plain the pines are mixed with the bald cypress, mangrove, tupelo, live oak, magnolia, and cabbage palm. Many of these trees are hosts for the mistletoe and are frequently draped with the long air plant called Spanish moss. Among animals of the Southern Pines Forest are the alligator, opossum, muskrat, snapping turtle, gopher tortoise, the coral and king snakes, and the rattlesnake. The Everglades of Florida afford a refuge for rare birds like the snowy egret, wood ibis, great white heron, and roseate spoonbill.

Western Forests. Largely because logging operations would be difficult and costly there, the *Rocky Mountain Forest* is the greatest expanse of coniferous forest which has survived in the United States. Extending from the Idaho panhandle to northern New Mexico, it is confined mostly to the slopes of the Rockies which are high enough to absorb the remaining moisture in westerly winds from the Pacific. Its most important trees are evergreens — the Idaho white pine, Colorado blue spruce, western larch, Engelmann spruce, and ponderosa and lodgepole pines. The only important broadleaf tree is the aspen, which is the first tree to grow after an area has been blighted by fire. The more distinctive flowers in the lower life zones of the district are the blue columbine, Indian paintbrush, bitterroot, and Mariposa and sego lilies. The alpine meadows above the timber line are dotted with such tiny plants as the goldflower and mountain pink.

Long the haunt of fur trappers and traders, the Rocky Mountain Forest is still noted for fur-bearing animals, among them the beaver, mink, weasel, raccoon, and marten. Other wildlife includes birds like the broad-tailed hummingbird, nutcracker, hermit thrush, and wild turkey, small mammals like the chipmunk, cottontail rabbit, and ground squirrel, and such flesh-eating (or carnivorous) animals as the golden eagle, coyote, and cougar, or mountain lion. The Rocky Mountain goat, bighorn sheep, white pelican, trumpeter swan, white-tailed ptarmigan, wapiti, or elk, and grizzly and black bears are also found here.

The *Pacific Coast Forest,* another coniferous district, is found principally on the western slopes of the Sierra Nevada and the Coast and Cascade ranges. Its tall trees are used extensively for saw timber; the more characteristic are the Douglas fir, western red cedar, Sitka spruce, yellow and sugar pines, and giant sequoia. Along the coast such unique evergreens as the coast redwood, the Torrey pine, and the wind-twisted Monterey cypress are found. The golden poppy and western cranesbill are among the flowers which grow in the foothills of the mountains. The Coast Ranges are the home of the large bird of prey known as the California condor. Other animals include the bobcat, or lynx, brush rabbit, mule deer, and California otter.

Grasslands. The grasslands of the United States are the broad stretch of open land between the eastern and western forest belts receiving a moderate rainfall. Their covering of tough, nourishing grasses, which once provided food for vast herds of American bison and pronghorn antelope, today sustains great numbers of cattle, sheep, and horses. As the amount of moisture decreases the grasslands change from the tall prairie grasses of the Central Plain to the short buffalo and grama grasses of the Great Plains. In the Mississippi Valley farm crops have largely replaced native grasses.

The Interior Plains are particularly gay from spring to fall with such field flowers as phloxes, daisies, shooting stars, and goldenrods. A few isolated trees like the alder and cottonwood and such shrubs as the sumac, hawthorn, and witch hazel rise above the flatness of the plains. The region abounds with herbivorous (or plant-eating) animals like the gopher, jack rabbit, and prairie dog. The carnivorous animals include the badger, fox, wolf, and weasel.

Desert. Because of the scant rainfall the region between the Rockies and the Pacific Highlands is mostly a desert. In the semiarid north, extending from eastern Washington to western Colorado, the vegetation consists chiefly of bunch grass, low shrubs like the sagebrush, and small evergreens like the piñon and juniper. The sagebrush is replaced on the salt flats of Nevada and western Utah by the greasewood and rabbit brush. Among the animals of this semiarid country are the sage grouse, scaled quail, and collared lizard.

The most typical plants of the Arid Tropical Region of southeastern California and southern Arizona and New Mexico are the drought-resistant shrubs known as the mesquite and creosote bush. There are also such forms of the yucca as the Joshua tree and such cacti as the prickly pear and saguaro. The thornbush grows as far east as

Rotkin, P.F.I.

RICHES TAKEN FROM THE EARTH have helped to make the United States a world power. Here is the Kennecott Utah Mine, largest of all open-pit copper mines.

southwestern Texas. Central California corresponds to certain Mediterranean countries in its growth of chaparral, or thickets, composed mostly of sagebrush and scrub oaks. Throughout the desert region there are found peculiar reptiles like the gecko, iguana, and Gila monster. The Southwest also affords a home for birds like the cactus wren, insects like the yucca moth, and mammals like the peccary, ocelot, and armadillo. Many of the mammals are omnivorous, eating both flesh and plants, for in the struggle for food in a desert region they have to feed on anything that will sustain life.

Furs and Fish. Although the fur trade has fallen from the high place it once held in the economy of the United States, trapping is still practiced as a part-time occupation in all states. It is especially important in Louisiana, where millions of muskrats are trapped yearly (see MUSKRAT). Foxes, minks, skunks, and other fur bearers also are trapped for their pelts. But most minks and silver and other mutation foxes are raised on fur farms. All chinchillas are farm-raised, as are most of the rabbits whose pelts are used by the fur industry. Fur farming is carried on mainly in the North Central states: Wisconsin, Minnesota, and Michigan produce more than half of the mink and silver-fox pelts produced in the United States. Whether from wild or farm animals, most peltries eventually are shipped to New York, where 90 per cent of the fur coats and other fur articles made in the United States are manufactured (see FUR).

In value, the fisheries of the United States lead those of all other countries. Fishing is an important industry in all the coastal states, and large quantities of fish are taken from the Mississippi and its tributaries and from the Great Lakes. The annual catch, including the more than 600,000,000 pounds of salmon yearly taken in Alaska, approximates 4,500,000,000 pounds. The tuna catch is by far the most valuable, the menhaden the greatest in weight. About one third of the total catch is sold as fresh and frozen fish, one third is canned, and a third used for bait or industrial purposes (see FISH).

Minerals and Mining

Mineral Resources. The United States is at once the world's leading producer and leading consumer of many of the most important minerals. It leads the world in the production of coal, iron, petroleum, lead, zinc, copper, and several other minerals. It also uses these minerals at a greater rate than any other nation. It still has enough bituminous coal and lignite to serve its needs for more than four thousand years, and its resources of some other minerals will last for long periods. But it has used most of its known reserves of some minerals, and its reserves of others are inadequate to supply its requirements. Thus for many minerals it is largely dependent on other countries. The periods for which its reserves of many important minerals will last are difficult to establish, since they depend upon a number of factors. For example, wartime rates of production and consumption may be very different from peacetime rates. Many mineral reserves furnish only a small part of the needs of American industries; and if foreign sources of supply were cut off and the American reserves had to be produced as quickly as the minerals were consumed, these reserves would be used up very rapidly. The extent to which domestic mines can take care of the needs of industry, and the extent to which the United States is dependent on other countries for important minerals, are shown in a graph on the following page.

A number of things may occur to make changes in the graphs necessary. To begin with, much remains to be learned about the actual mineral reserves of the United States. Mineral exploration is difficult and costly. Much may be deducted from geological conditions, but eventually drilling, digging, measuring, assaying, and other operations are necessary to prove the value of a deposit and the economic advantage to be gained by mining it. Large additional reserves of any of the minerals listed may later be discovered. This, of course, is true also of other countries. It is possible that the discovery of a rich mineral deposit in another country may make it possible for the United States to buy the mineral abroad cheaper than it can be produced at home. The contribution of the domestic mines would then be reduced. Again, the reserves listed are merely "commercial reserves," those from which minerals may profitably be recovered by present mining and processing methods. It is likely that improved methods of mining or processing may make it possible to use ores now too difficult or too poor to be worked. Finally, changes in the demand for certain minerals by industry may lengthen or shorten the periods for which the reserves will last.

There are some minerals of which the United States need never fear a shortage. This is especially true of nitrate, which may be obtained from the atmosphere, and of salt, magnesium, and certain other minerals that may be recovered from sea water. Sand, gravel, and clays exist in almost inexhaustible quantities; and the United States has huge resources of limestone, gypsum, slate, marble, phosphate rock, granite, and other valuable minerals. See MINERALS; also articles on the states and separate articles on the various minerals.

Mining. United States mines make a great contribution to the national wealth. The annual value of mineral products varies from year to year with business conditions and prices. Perhaps a fair average would be between five and six billion dollars, though the total has exceeded fifteen billion dollars in a year. Mining of one kind or another is conducted in all states. In value of products, the leading mineral states are Texas (oil), Pennsylvania (coal), West Virginia (coal), California (oil), Illinois (coal), Oklahoma (oil), and Kentucky (coal). From this list it is obvious that the fuels lead all other minerals in value. Other important nonmetallic minerals are natural gas, cement, asphalt, and sulfur. The most valuable metallic products are iron, copper, aluminum, zinc, and lead.

Agriculture

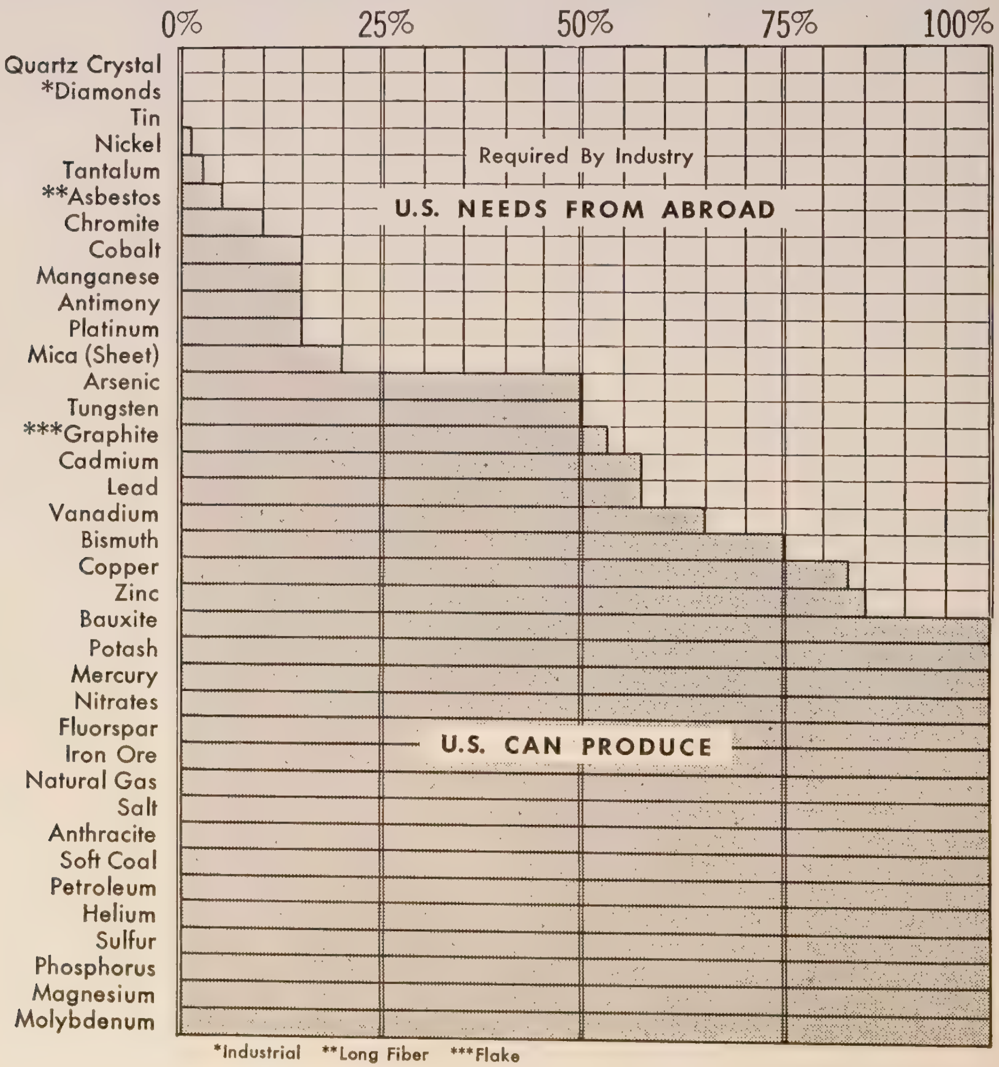
America's farms cover about 60 per cent of the land area of the United States, and pastures and grazing lands not included in actual farms occupy another 15 per cent of the land. Only 35 per cent of the farmland is used to grow crops. Much more, about 46 per cent, is taken up by pastures. The rest of the farmland consists of farmsteads (where the farm buildings are located), woodlands, roads, and other uncultivable areas.

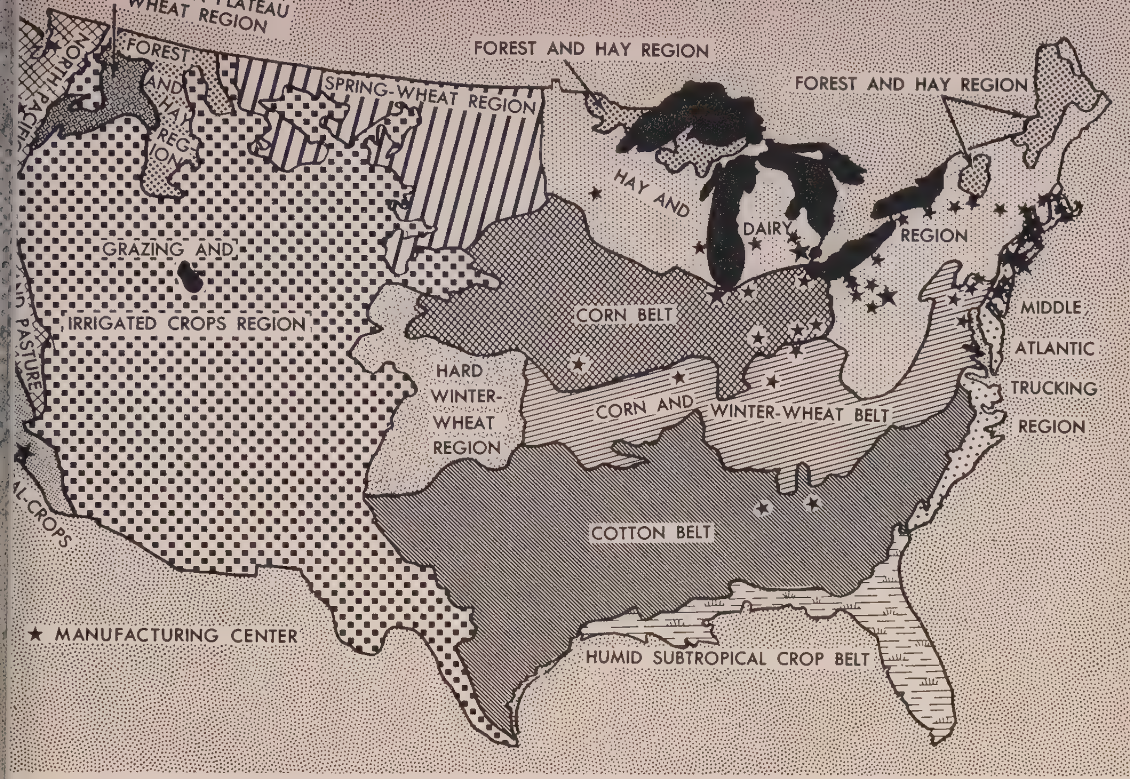
Although the cultivated area may seem comparatively small, it is vastly important. It amounts to 18 per cent of all the cultivated land in the world — more than is cultivated by any other single country. It produces about 58 per cent of the world's corn, 21 per cent of its wheat, 47 per cent of its cotton, 36 per cent of its soybeans, 11 per cent of its cattle, 24 per cent of its hogs, and one third of its milk (see graph).

The farmland is divided among almost 6 million farms. The lands and buildings of these farms have a value of about 65 billion dollars. The machinery on them is worth more than 11 billion dollars. Their livestock has a value of about 14 billion dollars, and the crops stored on them are worth about 9 billion dollars. Thus America's farms have a value of about 100 billion dollars.

Production Areas. The wide variations in climate, soils, and topography in the United States, combined with an excellent transportation system, have brought about the development of areas in which certain types of farming predominate. These agricultural production areas are shown on the accompanying map.

THE LONG AND SHORT OF AMERICAN MINERALS





In the *Hay and Dairy Region* much of the land is hilly and therefore poorly suited to growing row crops because of the danger of erosion (see CONSERVATION; EROSION; SOIL). Legumes and grasses are better plants for the hilly land because they hold the soil in place and are also good feeds for cattle. The rainfall is ample for the growth of good pasture, and there is sufficient level land to grow most of the corn, oats, barley, and other feeds required by cattle. In this region, too, are most of America's largest cities, with their great demand for milk and milk products. Thus the region is ideal for dairy farming (see DAIRY FARMING). Near the Great Lakes, fruit growing is an important branch of farming. Tobacco and vegetables are other important crops in this region.

The *Forest and Hay Region,* one of poor soils and rugged land, is better for forestry than agriculture, and most of the land is forested. But potatoes are very important in Maine, where Aroostook County produces a larger crop than any other area of comparable size in the United States.

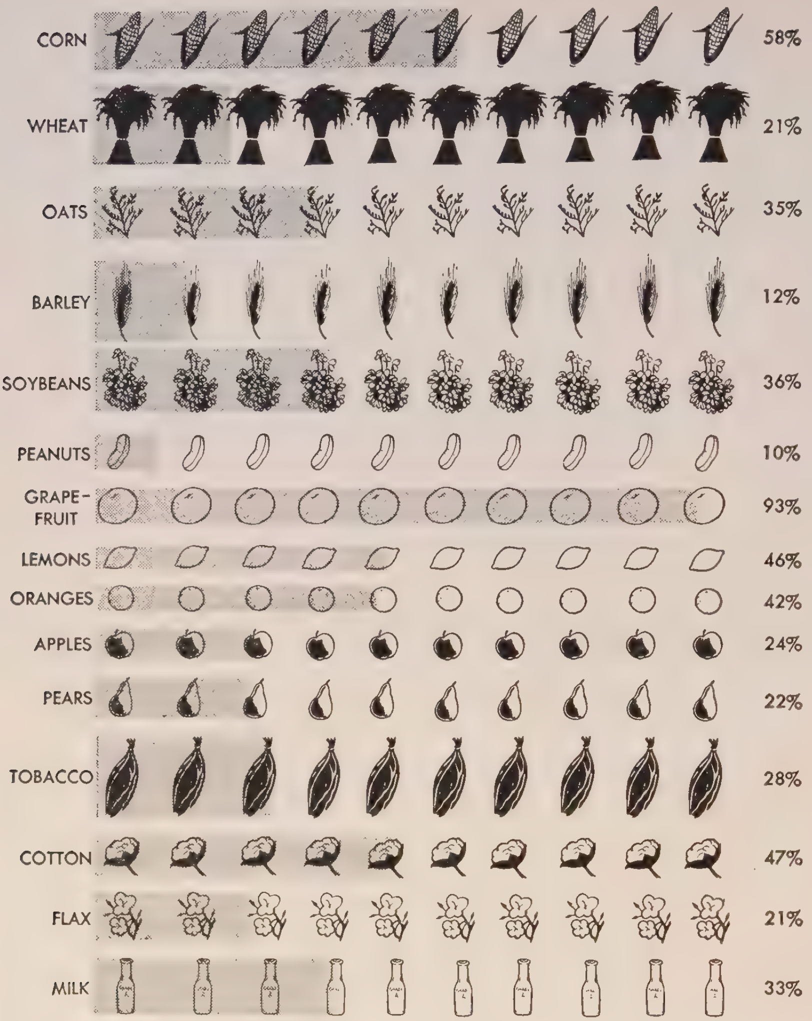
In the *Middle Atlantic Truck Crop Belt,* soils are generally poor and require a good deal of fertilizer. But moisture is abundant, temperatures are modified by the ocean, and under intensive cultivation large, money-making crops of vegetables are produced for the populous cities of the East. The nearby markets make poultry farming another profitable occupation.

In the *Humid Subtropical Crop Belt,* rain leaches the plant foods from the soil, but climatic conditions make it possible to grow citrus fruits, figs, and other tender fruits. Here, also, vegetables are grown for northern markets in late and early season, before the nearer farms are able to produce. Sugar cane, rice, peanuts, sweet potatoes, and tung nuts also are grown in this belt.

The *Cotton Belt* has a long growing season and mild winters. Rainfall is plentiful in the east, sparse in the west. Typical of the hilly eastern and central parts are small farms, often operated by sharecroppers (see COTTON). But in the west are large, highly mechanized farms. Corn, peanuts, sweet potatoes, rice, and fruits also are grown. Hogs are widely raised, and cattle are important in the west. Huge crops of tobacco are produced in the Carolinas.

In the *Corn and Winter-Wheat Belt,* soils and climate are well suited to growing corn, but rain is so plentiful that hard wheat cannot be grown. Hence soft wheat, better for making cakes than bread, is produced. Tobacco is a very important crop in this area. Good grasses and legumes grow on the rolling land, and the region is important in the production of cattle and hogs.

In the *Hard Winter-Wheat Belt,* winters are mild enough to make it possible to sow wheat in the fall. But rain is scantier than it is in the Soft-Wheat Belt, and hard wheat, good for breadmaking, is grown. Because of the scarcity of moisture and the consequent danger of wind erosion, large areas of land cannot be plowed but must be used for grazing (see DUST, *Dust Bowl*).



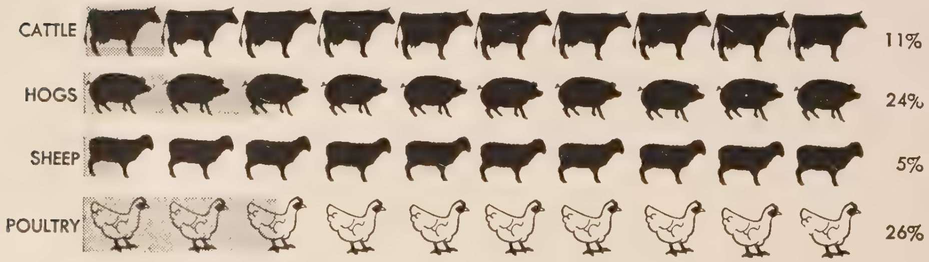
PERCENTAGES OF WORLD CROPS GROWN BY THE UNITED STATES

EACH SYMBOL REPRESENTS 10% OF THE TOTAL WORLD CROPS

SHADED PORTION INDICATES CONTRIBUTION OF U. S.

PERCENTAGES OF WORLD LIVESTOCK RAISED BY THE UNITED STATES

EACH SYMBOL REPRESENTS 10% OF THE TOTAL



In the *Spring-Wheat Belt,* winters are too cold for fall sowing. Wheat is seeded in spring. The brief, hot growing season and the scant rainfall are ideal for growing the hard wheats that make the best bread and macaroni (see GLUTEN; MACARONI; WHEAT). Dry farming is often necessary in this region.

The *Corn Belt* is the richest farming region in the United States. The land is generally level, the soil deep and fertile, and the climate is especially favorable for growing corn (see CORN). The abundance of corn, the chief fattening feed grown in the United States, makes this region the country's leading producer of livestock. More than half of America's hogs are raised in the Corn Belt, and a large percentage of its beef cattle are raised or finished for market in this region. Poultry and eggs are produced in huge quantities, and the production of spring lambs is an important industry. Great quantities of milk and milk products also are produced. Soybeans and oats are important crops.

Most of the *Grazing and Irrigated Crops Region* cannot be cultivated. Because of the scarcity of rain it is suited only for grazing cattle, sheep, and goats. A large area is in the public domain, to which ranchers lease rights from the national government (see LANDS, PUBLIC). This is the land of the cowboy and the sheepherder (see COWBOY). Vast ranches cover thousands of acres, and huge flocks of sheep are herded from place to place. Much of the beef and most of the wool, lambs, goats, and mohair produced in the United States come from this region (see GOAT; SHEEP). In the irrigated areas, apples, cherries, sugar beets, truck crops, and alfalfa are grown (see IRRIGATION). Near the mouth of the Rio Grande, in the extreme southeast, is one of the leading citrus-fruit areas of the United States. Wheat, sorghums, and other crops are raised by dry farming.

The *Northwest Forest and Hay Region* is a natural forest region. Legumes and grasses grow well on the slopes, and dairying and grazing are important branches of farming. Sugar beets, tree fruits, and small grains are grown in the fertile valleys.

The *Columbia Plateau* is a region of scant rainfall and rich soil formed from fragments of volcanic materials blown from craters in times past. Wheat is an important crop, and under irrigation abundant yields of apples, pears, sugar beets, and other crops are produced.

The *Northern Pacific Forest, Hay, and Pasture Region* is the principal forested area of the United States. Rainfall is abundant, and temperatures, modified by the Japan Current, are mild except in the mountains. Dairying and the production of beef cattle are important, and the fertile valleys produce great crops of apples, pears, prunes, other fruits, truck crops, and cereal grains.

In the *Pacific Subtropical Crops Region,* rainfall is low and irrigation is necessary, but climatic conditions make this one of the most favored agricultural areas in the world. Oranges, lemons, grapes, peaches, apricots, almonds, and other tender fruits and nuts are produced in huge quantities. Great amounts of tomatoes, asparagus, lettuce, and other truck crops also are grown. The region is one of the most important cotton-producing areas in the United States. Alfalfa, rice, and other small grains are also raised with profit.

Manufacturing

The United States is pre-eminently a manufacturing country. In volume and variety of manufactured goods it surpasses any other country. It produces between one third and one fourth of all the manufactured goods in the world, and its products range from gigantic metal castings to the most delicate and precise scientific instruments. Its manufacturing plants employ about one third of its nonagricultural workers.

Foundations of Leadership. There are several reasons for the high place the United States has attained in manufacturing. It has vast resources of iron, copper, and other minerals. Its forest resources, though greatly depleted, still furnish huge quantities of lumber, wood pulp, and other forest products; and its farms supply manufacturing plants with cotton, starches, oils, and other substances, as well as materials for the great food-processing industries. The country has great resources of coal and petroleum to supply fuel for its engines, and its streams provide many sites for hydroelectric power plants. Its efficient agriculture enables a comparatively few workers to supply the food and other agricultural needs of other workers, and thus assure reserves of manpower for the manufacturing plants. Its excellent transportation system, including railways, highways, waterways, airways, and pipelines, makes it possible to carry raw materials to the factories and manufactured goods to markets easily, quickly, and cheaply. There are no tariffs or other barriers to trade among the states; the markets of all are freely open to each.

The United States has a good supply of well-educated, efficient workers, who are paid enough to enable them to buy most of the consumer products of its factories. Its businessmen are alert to the importance of creating markets for new products, and keen competition has made them eager for new and more efficient methods of production. America's investors have been willing to assume the risks of starting new enterprises. Its inventors have created devices as fundamental as the cotton gin, the sewing machine, the typewriter, the telegraph, the electric light, the airplane, and many other basic inventions (see INVENTION). Invention is no longer left to the initiative and small financial resources of exceptional individuals. Corporations maintain research staffs for the purpose of devising new products, better machines, and improved processing and handling methods. Research is conducted also by such institutions as the Rockefeller Foundation and by government agencies such as the Bureau of Standards, the Forest Products Laboratory, and the Regional Research Laboratories.

Manufacturing Districts. Manufacturing is concentrated in the area east of the Mississippi and north of the Ohio River. World War II brought a marked shift of manufacturing to the South and to the Pacific Northwest and the Pacific Coast, but the northeastern region is still responsible for about two thirds of the value of all United States manufactures. The New York-Northeastern New Jersey district alone produces about 12 per cent of the country's manufactures, and the Chicago district produces 12 per cent. The principal manufacturing districts are shown on the accompanying map.

Chief Manufactures. The great iron-and-steel industry leads in value of products. It is based mainly on the iron mines of the Lake Superior region, the limestone deposits about the Great Lakes, and the nearby coal fields of Pennsylvania, West Virginia, Ohio, and Illinois (see COAL; IRON; LIMESTONE). It is centered in the Great Lakes region, chiefly in Pittsburgh, Bethlehem, and other cities in western Pennsylvania, and in the Chicago-Gary district (see STEEL). It is in this region, close to the steel supply, that the great machinery industries are centered. Detroit is the great leader in the automobile industry, but motor vehicles and parts are made also in many other Michigan cities and in many other states (see AUTOMOBILE). Farm machinery is manufactured mainly in the Midwest, close to the area where it is most in demand. Chicago leads in its production. The vitally important machine-tools industry is concentrated mainly in New England and in Ohio, Illinois, Michigan, and Wisconsin (see MACHINE TOOLS AND MACHINING).

The food industries employ about 10 per cent of all workers engaged in manufacturing. They include meat packing, grain milling, the preparation of breakfast cereals and of pie, cake, and other mixes, baking, the manufacture of dairy products, and food preservation by canning, drying, and freezing. They also include the brewing, distilling, and soft-drink industries. Foods are usually processed near where they are produced, though where cheap transportation permits, plants may be established at points between production areas and large markets. Thus the great meat-packing centers are in or near the Corn Belt (see MEAT PACKING), and the chief grain-milling centers are located near the eastern margins of the hard-wheat areas or on the Great Lakes (see FLOUR). See also BUTTER; CANNING; CHEESE; DEHYDRATED FOODS; REFRIGERATION; and other articles on food products and food processing.

The textile industry began in New England in the days when water power was the chief means of turning the machines in mills. New England is still an important producer of textiles, but about two thirds of the textile industry is now located in the South, where North Carolina is its chief center. More than two fifths of men's and boys' clothing and about 70 per cent of women's garments are made in New York City (see GARMENT INDUSTRY). Rochester, N. Y., is another important producer of men's clothing. The shoe industry is most highly concentrated in Massachusetts, though there are important centers in New York, New Hampshire, Missouri, and Illinois.

The most swiftly growing of all American industries are the chemical industries, which produce an ever-growing list of plastics, synthetic fabrics, insecticides, herbicides, dyes, flavorings, perfumes, detergents, drugs, and other useful products. See list of topics under INDUSTRY.

Transportation and Communications

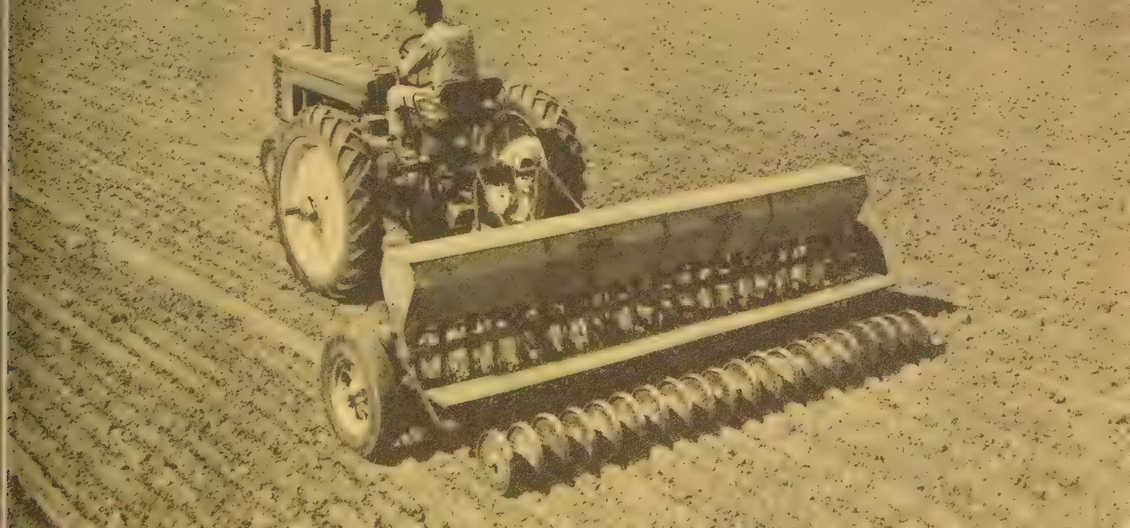
Merchant Marine. The United States has a larger fleet of merchant ships than any other country, but fewer than half of its vessels are in service. In times of peace American ships cannot successfully compete with the more cheaply operated vessels of other countries. It is chiefly for military purposes — to transport men and matériel — that the United States needs a large merchant fleet (see MERCHANT MARINE).

Inland Waterways. Although waterways are now less important than they were before the coming of the railroads and other swifter means of transportation, rivers, lakes, and canals still play an important part in the transportation system of the United States. The Great Lakes Waterway, with its connections with the Atlantic by way of the Hudson and St. Lawrence rivers, carries a greater freight tonnage than any other comparable waterway in the world. Another important artery is the Mississippi River, which has connection with the Great Lakes by way of the Illinois Waterway (see CANAL; GREAT LAKES; INLAND WATERWAYS OF THE UNITED STATES; MISSISSIPPI RIVER; NEW YORK STATE BARGE CANAL; SAINT LAWRENCE WATERWAY; SAULT SAINTE MARIE CANALS; WELLAND CANAL).

Railroads. The United States has 225,000 miles of railroads, or about one third of the railroad mileage in the world. Its transcontinental lines are linked with numerous other roads, and there are connections with the railways of Canada and Mexico. Railroad equipment includes about 45,000 locomotives, 40,000 passenger cars, and 1,785,000 freight cars with an average capacity of about fifty-two tons each. The railroads carry about one and one-half billion tons of freight and from six to eight million passengers yearly, but their business has been hard hit by competition from buses, trucks, and air-

NOT FROM THE LAND ALONE comes the wealth of foods, fibers, and oils provided by American agriculture, but from human ingenuity and skill applied to the land. The goal is the greatest production with the least labor. Mechanical horsepower has replaced the horse and made the farmer a mechanic. Plants and animals are scientifically bred and fed for efficient production.

U.S. Forest Service Photo; Rural Electrification Administration; John Deere



INDUSTRIAL MIGHT is founded on steel. America's great steel industry provides the raw materials for agriculture, transportation, mining, and manufacturing.

United States Steel Corporation

lines, and private automobiles carry many persons who would otherwise travel by rail (see Railroad).

Highways. More than 3,000,000 miles of roads crisscross the United States. Of these, 350,000 miles are included in the primary state-highway systems. More than half of the roads are surfaced. In type the roads range from narrow dirt roads to superhighways with from four to eight lanes, surfaced with concrete or other durable materials (see Roads and Highways). It is over the highways that most of the traffic in the United States moves. The greatest number of passengers travel in private automobiles, of which there are about one for every four persons in the United States (see Automobile). Buses carry up to a billion or more persons yearly in intercity service; charter buses serve about 5 per cent of this total. The number of persons carried yearly by buses in city and suburban traffic is about four times the world's population.

Most of the freight moved in the United States is carried in trucks at one time or another. Some trucking companies operate coast-to-coast services, and many are engaged in intercity service for shorter distances. Yet the freight moved in intercity service is only a small portion of the total freight moved by trucks, most of which is carried in local service.

Air Service. Some forty airlines operate scheduled air service within the United States, and a third of these offer international service. Numerous other lines conduct nonscheduled service (their planes do not leave at stipulated times). The scheduled airlines alone yearly carry more than 15,000,000 persons on flights within the United States and about one tenth of this number on international flights. In addition, the planes carry millions of tons of freight, express, and mail.

Pipelines. An extensive system of pipelines transports crude petroleum, refined petroleum products, and natural gas to various sections of the United States. Some of the lines extend from production centers to points more than a thousand miles distant. On a much smaller scale, molasses and some other substances also are carried by this method (see Pipelines).

Communications. Among the means of public communication in the United States, the Post Office Department is unique in that it is a government monopoly. All other means of civil communication are privately owned and operated, though carriers of messages between the states or between the United States and other countries are subject to regulation in the public interest by the Federal Communications Commission (see Federal Communications Commission). The United States has more than half of all the telephones in the world, and its telephone system handles millions of calls daily (see Telephone). The telegraph system is also highly developed. About one third of the millions of miles of telegraph wires that crisscross the world are found in the United States (see Telegraph). In America, too, radio has become a major form of communication, with regular broadcasting stations serving every community and thousands of special stations in operation, such as those transmitting messages to ships, aircraft, police cars, and taxis. Almost every American family has at least one radio set (see Radio). It was not until after World War II that large-scale production of television sets began, but by mid-century millions of sets were in use and the number was rapidly growing (see Television).

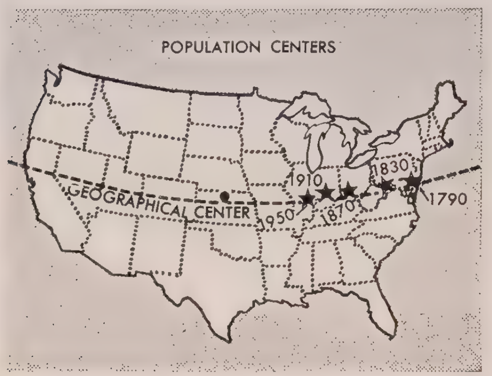
More than 10,000 newspapers, ranging from large metropolitan dailies with more than a million circulation to village weeklies with circulations of only a few hundred, are published in the United States (see Newspaper). Besides the newspapers, there are thousands of magazines, with a total circulation of many millions (see Magazine). In addition, vast numbers of books and pamphlets are sold yearly.

The American People

The census takers who counted the inhabitants of the United States in 1950 listed 150,697,361 people, or about one sixteenth of the world's population. When the first count was made in 1790, the total was 3,929,214. Some of this enormous increase in population occurred because in each year there were more births than deaths. The death rate is less than 10 for every thousand people in the nation, while the birth rate is more than 24 per thousand. But the popula-

Census	Population Continental United States	Increase	
		Number	Per Cent
1950........	150,697,361	19,028,086	14.4
1940........	131,669,275	8,894,229	7.2
1930........	122,775,046	17,064,426	16.1
1920........	105,710,620	13,738,354	14.9
1910........	91,972,266	15,977,691	21.0
1900........	75,994,575	13,046,861	20.7
1890........	62,947,714	12,791,931	25.5
1880........	50,155,783	11,597,412	30.1
1870........	38,558,371	7,115,050	22.6
1860........	31,443,321	8,251,445	35.6
1850........	23,191,876	6,122,423	35.9
1840........	17,069,453	4,203,433	32.7
1830........	12,866,020	3,227,567	33.5
1820........	9,638,453	2,398,572	33.1
1810........	7,239,881	1,931,398	36.4
1800........	5,308,483	1,379,269	35.1
1790........	3,929,214	——	——

tion also grew because millions of immigrants came from other parts of the world to find a new home in America. Between 1820 and 1938 about 38,000,000 of them landed on American soil.



THE CENTER OF POPULATION (stars) has moved westward with the passing years, toward the geographical center of the nation (dot).

Races and Nationalities. All Americans are either immigrants or the descendants of immigrants. Even the Indians, who occupied the New World long before it was discovered by the Europeans, are descended from Mongoloid hunters who probably crossed from Asia into Alaska in prehistoric times. The earliest European settlers were the Spanish, who moved northward from Mexico and left their mark on the Southwestern states, California, and Florida; the French, who established colonies along the St. Lawrence, the Great Lakes, and the Mississippi; and the English, who spread westward from the villages they founded along the Atlantic coast from New England to Georgia. The Dutch in the Hudson Valley and the Swedes in Delaware were not far behind, but they were not so powerful and so numerous as the Spanish, the French, and the English.

For a long time after the first settlement of the continent, most of the people who came to America were from northwestern Europe: the British Isles, Scandinavia, Germany, and the Netherlands. In the late nineteenth century and the first part of the twentieth, millions came from central and southeastern Europe. For nearly two hundred years, between 1619 and 1808, Negroes were brought by force from Africa to work as slaves on the land, especially in the South. This mixture of many different nationalities and many different cultures (ways of living), in a new land, turned out to be a new people, the Americans.

All three great racial stocks — Caucasoid, Mongoloid, and Negroid — are represented among the American people. A little less than 90 per cent are classified as whites, or Caucasoids, and a little more than 10 per cent as nonwhites. There are about 13,000,000 Negro Americans. The Mongoloids, who include the American Indians, the Aleuts and Eskimos, Japanese, Chinese, and other Asiatics, number about a million.

By the middle of the twentieth century, the people born in foreign countries, plus the American children who had at least one foreign-born parent, totaled about 34,500,000, or about one quarter of the population. More than 5,000,000 gave Germany as the country of their origin. Four and a half million named Italy, and nearly 3,000,000, Poland. Next on the list were Russia, with 2,600,000, and Ireland with 2,400,000. The large number from the British Commonwealth included 2,000,000 English-speaking Canadians, 900,000 French Canadians, 2,000,000 English, 700,000 Scots, 375,000 Northern Irish, and 150,000 Welsh. Sweden, Austria, and Mexico each contributed more than a million. Somewhat smaller numbers came from many other European countries.

Rural and Urban Dwellers. Sixty-four out of every hundred Americans live in towns of more than 2,500 inhabitants or in smaller villages that are on the fringe of some city. There are about 96,000,000 people in these *urban* areas, and only about 54,000,000 in the rural districts, that is, on farms and in small country towns. Half of the urban dwellers live in the 106 cities that have a population of more than 100,000 each.

In early times most of the American people lived on the land, but each census has shown that across the years they have been moving from the farms into the towns and cities. Work in the cities is often better paid and easier than work on the land, and machines have taken the place of men in many farm operations, so that the farmer is able to raise more food without having to hire more help. There is a great difference from one region to another, and from one state to the next, in the ratio between country and city dwellers. In the long-settled Northeast, 80 per cent of the people are called urban dwellers. In the West the average is about 70 per cent, and in the South it falls below 50 per cent. The Middle West is close to the national average of 64 per cent. Only 13.4 per cent of the people in New Jersey live in rural areas, while in North Dakota 72.2 per cent are country people.

Americans have always had a tendency to move from one part of the country to another, in search of better land, higher wages, or the thrill of adventure. The greatest movement was from the east toward the west as the country was opened to settlement. The population center of the United States, which in 1790 was east of Baltimore, has shifted to the west until in 1950 it was at 38°50′

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The Story of America is a story of movement — of travel and transportation. It is a story of people spreading out across a vast, unexplored continent and building a mighty nation, of men and women who were not afraid of new places and strange surroundings. To get to these new places and to survive there, the people needed transportation routes connecting the frontier with the settled regions in the east. Such routes carried their produce back to market and brought them the manufactured goods they had to buy. And so there began the building of the roads and, later, the railroads which today form gigantic networks throughout the land. But in the period when roads were still few and primitive — before railroad construction had developed — canals linked the eastern seaboard and the Middle West. Indeed, the gay box this canal-boat captain proudly displays links the Ohio frontier with millinery shops of far-off Paris.

The Story of America is a story of communication—of town criers and newspapers, of the pony express and the United States mail, of radio and television. If the railroad bound the nation together with bands of steel, the telephone and telegraph bound its people together with copper wires. And, like the laying of railroad track across the continent, the setting up of communication lines from coast to coast was essential to the growth of the nation; indeed, national greatness depends far more on the exchange of information and ideas than on the transportation of passengers and freight.

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The Story of America is a story of business — big business and small. It is the story of giant corporations and huge industries, of mail-order houses and department stores, of supermarkets and chain stores with branches in a hundred cities. And it is the story of the old fashioned, small-town general store, where you could buy almost anything in the world you needed — or just sit around and chat with your friends. It is the story of the descendants of that wonderful institution — the corner drugstores and candy shops and grocery stores and little businesses of all kinds that thrive in America today. The men and women who own these shops and stores, along with the great industrialists and bankers and company presidents, and the owners of small homes or a few shares of stock, are the capitalists of America — free men who have worked side by side to build a free and prosperous nation.

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The Story of America is a story of traffic — of shiploads of immigrants crossing the sea lanes to the New World, of long lines of prairie schooners trekking westward across the continent, of steamboats snorting up and down the Mississippi. Today, sleek automobiles streak endlessly along the broad highways that crisscross the nation, and in the skies above America the rumble of mighty airplane engines never ceases. In the cities, traffic clogs the streets so seriously that many shake their heads in despair. But traffic jams are no new problem in America. Before the automobile appeared, wagons, carts, and carriages pulled by horses rattled over the cobblestones of urban America, causing tie-ups and accidents that set heads shaking then. Horns blow, bumpers lock, and engines stall, but traffic continues to move. And, with it, America continues to go forward, as it has throughout its history.

north latitude and 88°10′ west longitude, near Dundas, Ill.

Even after the frontier had been pushed back to the shores of the Pacific, each census showed that large numbers of people had moved. Between 1940 and 1950 the ring of Western states from New Mexico to Washington showed a very large increase in population, as did Florida. Four states — North Dakota, Oklahoma, Arkansas, and Mississippi — had fewer inhabitants in 1950 than in 1940. There are about fifty Americans for every square mile of land in the United States.

For 1950 populations of American cities of over 43,000, see the article POPULATION.

How Americans Live. The farm people of America live in about 6,500,000 homes. In four out of ten farm homes water is piped into the house, and two out of ten have a bath and toilet. In the country towns about half the dwellings have inside plumbing, and of the 29,300,000 urban homes nearly 80 per cent are so equipped. The mid-century census showed that 50 per cent of the American families owned the homes in which they lived, while about 42 per cent were renters.

Americans work at all sorts of jobs. From 60,000,000 to 65,000,000 people are in the labor force, that is, earn a living in one way or another. About 6,500,000 are farmers operating their own or rented farms or working for wages on the land. The rest are employed in factories, mills, mines, and other industries; in trade, transportation, communications, the professions, and in many kinds of services. Less than 20 per cent are unskilled. Skilled workers and foremen account for 36 per cent of the total; another 36 per cent are clerks, salespeople, owners or managers of businesses, and other white-collar workers; and 7.5 per cent are doctors, lawyers, engineers, teachers, and other members of the professional class. Some 16,000,000 workers are women. The American worker's average yearly wages are the highest in the world. He is also probably better trained and has more experience and better tools and equipment than any other worker.

How Americans Worship. Americans, who are free to worship as they please, belong to many different religious groups. Some are followers of non-Christian religions, but the great majority are members of Christian churches. The Protestant denominations have about 49,000,000 members. There are about 28,000,000 Roman Catholics, 5,000,000 Jews, and more than 1,000,000 Mormons.

The American Character. Because the American people originated in so many different parts of the world, they are not alike in their physical make-up, in their customs, or in their ways of thinking, but some characteristics, some habits, and some ideas are common to most Americans. The United States was populated principally by Europeans, who brought their customs and ideas with them, but just as these men and women of many nationalities became Americans, their many different ways of living merged into a new culture, the American.

Foreigners who visit the United States usually find the American people friendly, energetic, good-humored, and optimistic. They marvel at the American ability to produce skyscrapers, cars, telephones, radios, and goods of many kinds, and they sometimes complain that Americans are interested only in material things.

Many different elements shared in the formation of the national character. The tradition of political democracy, which is based on belief in the dignity and importance of the individual, gave confidence and hope to the people. The great natural wealth of the United States, which offered opportunity to millions, made optimism the natural outlook of the Americans. Energy, self-reliance, and inventiveness were necessary qualities in the sturdy pioneers who pushed back the western frontier and settled vast new lands.

These same qualities played a large part in making the United States the leading industrial nation of the world. The American interest in practical matters and the philosophy of pragmatism (let's try it and see whether it works) led to many inventions, new ways of doing things, and the creation of wealth. It has also led to the development of a society that puts a high value on material possessions and financial success. The accusation that Americans care more for material gains than for spiritual worth is contradicted, however, by their quick generosity toward people who are overtaken by disaster. Emphasis on material progress is also a frontier characteristic.

American society is not fixed in any mold. It is based on the belief that a new idea should be tried out and tested, just as an individual should have his chance to make good. Americans believe in the greatest possible freedom of action for each human being, and they also believe that society must try to achieve the greatest good for the greatest number of people. When the interest of the individual clashes with the interest of society, a compromise has to be worked out.

American life is generally informal. For recreation people like to listen to radio or television programs, go to the movies, dance, or watch games like basketball, baseball, or football. Americans travel freely by car, bus, train, or plane. There are so many automobiles in the United States that the whole population could go riding at the same time. Outdoor sports are popular.

American Education. Education is important to Americans. Every state has laws requiring children to attend school for certain periods of time each year. The requirements differ from state to state, but, in general, school attendance is compulsory between the ages of six and sixteen, with eighteen years the age limit in some cases. The length of the yearly school term varies from three months in a few states to ten months in more advanced states. In more than half of the states the term is eight or nine months. Public high schools and state universities offer tuition-free education beyond the grammar-school level. There are about 145,000 public and 10,000 private elementary schools; 25,000 public and 3,000 private secondary schools; and more than 600 public and 1,000 private colleges, universities, and professional schools. About 24,000,000 children between the ages of five and seventeen are enrolled in the public schools. Nearly 2,500,000 students are in institutions of higher learning. On the other hand, between 2 and 3 per cent of the Americans who are fourteen years of age or older are unable to read or write any language and are classed as illiterate; and out of every five boys and girls mentally capable of completing a college course, only one graduates from a college or university.

American public schools are nonsectarian; that is, they are not connected with any religious organization. They are under the direction of the various state governments. The Federal Government, through the Office of Education in the Federal Security Agency, gives advice to the state departments of education, handles such Federal grants to the states as those in aid of vocational training, and collects information about education; but it does not interfere with the state and local administration of the school programs. See EDUCATION; SCHOOLS.

Cultural Aspects. American literature, art, music, philosophy, and science, which had their origins chiefly in Europe, have acquired a character that reflects the independence and freedom of the American tradition. The American speech, although it is still English, has a flavor and a liveliness that is all its own. It has borrowed useful or colorful words from many languages and invented new ones when it seemed necessary. Negro Americans gave the world new musical forms in jazz and other kinds of dance music. American scientists have carried on research in pure science, for the sake of adding to man's knowledge of nature, and have also worked to solve practical problems. Both kinds of research have been very valuable to American life.

Most Americans believe firmly in democracy, equality, and freedom, and if, at times, they fail to act according to these principles, they never lose hope that the American social system will grow closer to the ideal.

Government

How America's Government Developed. The United States has taken a leading part in the development of government by the people. In ancient times pure democracy had flourished for a while in Greek city-states, and a republican form of government had existed temporarily in Rome (see GOVERNMENT). Thereafter, authority passed into the hands of emperors, kings, and nobles. The common people had nothing to do with the government except to obey its laws, pay its taxes, and fight its wars. Only in the Italian city-states and the Swiss cantons did ideas of popular rule survive. In England, however, the Magna Carta of 1215, the Petition of Right of 1628, and the Bill of Rights of 1689 were early steps taken to protect the rights of the people.

In America the Mayflower Compact, drawn up by the Pilgrims in 1620, was the first step toward self-government (see PILGRIMS). Throughout the colonies the people gained experience in running their own affairs, and on many occasions the colonial leaders defended the people's rights against British governors. Life on the frontier developed a spirit of liberty, equality, and self-reliance. It was this spirit that led to the Revolutionary War, when England tried to tax the colonists without their consent.

On July 4, 1776, the Continental Congress of the rebellious colonies adopted the Declaration of Independence, proclaiming the colonies free and independent states. At first, under the Continental Congress, these states were separate units co-operating in the common war effort. The Articles of Confederation provided for a union of states under a central government, and when this organization failed to work out, the Federal Constitution was drafted in 1787 in order to form a more perfect union.

The Federal System. The most important feature of the Constitution is the federal system of government. A federal state or federation is a union of self-governing states under one central government. In the United States the government at Washington is commonly called the Federal Government; more accurately, it is the central government in a federal system.

The unification of the thirteen independent states into one national state was the first successful federation in world history. Many earlier attempts to unite separate states into leagues or confederations had failed because the central government was not given enough authority to govern, as was the case in America under the Articles of Confederation. The American Constitu-

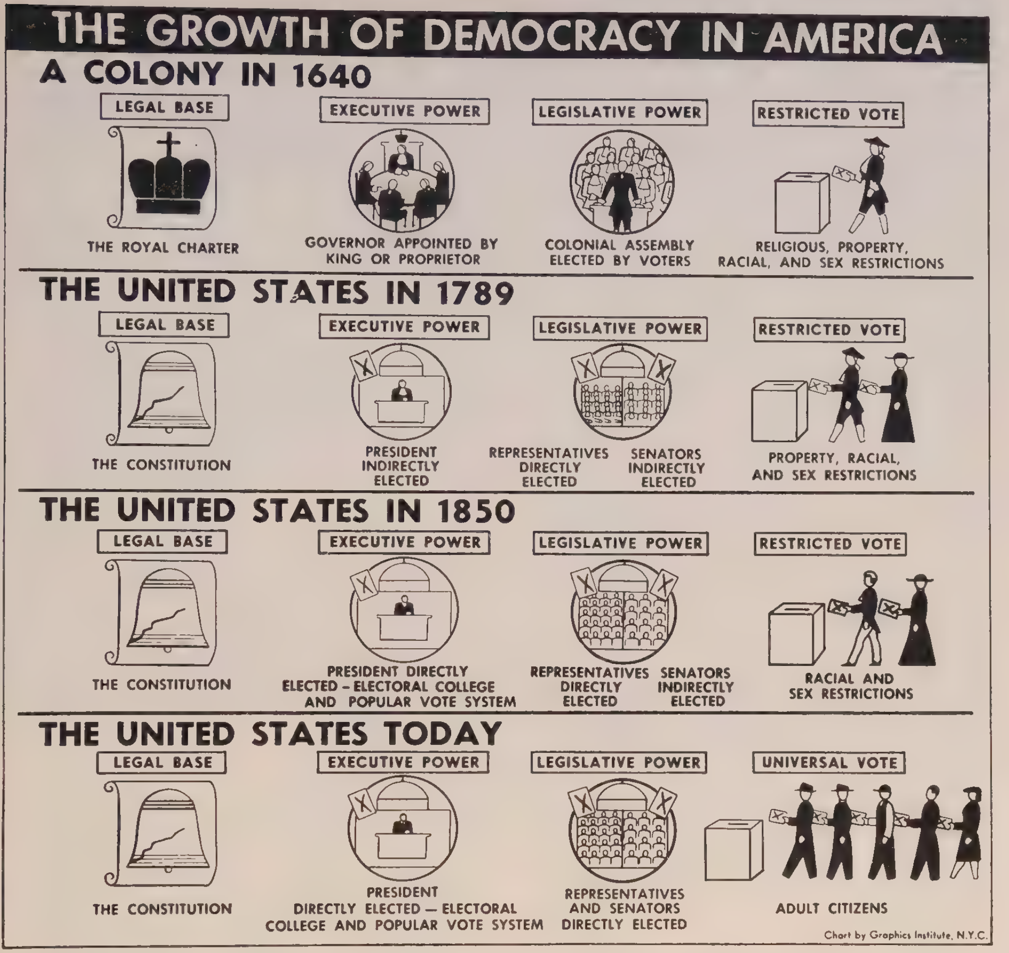

THE GROWTH OF DEMOCRACY IN AMERICA
A COLONY IN 1640
LEGAL BASE
THE ROYAL CHARTER
EXECUTIVE POWER
GOVERNOR APPOINTED BY KING OR PROPRIETOR
LEGISLATIVE POWER
COLONIAL ASSEMBLY ELECTED BY VOTERS
RESTRICTED VOTE
RELIGIOUS, PROPERTY, RACIAL, AND SEX RESTRICTIONS
THE UNITED STATES IN 1789
LEGAL BASE
THE CONSTITUTION
EXECUTIVE POWER
PRESIDENT INDIRECTLY ELECTED
LEGISLATIVE POWER
REPRESENTATIVES DIRECTLY ELECTED
SENATORS INDIRECTLY ELECTED
RESTRICTED VOTE
PROPERTY, RACIAL, AND SEX RESTRICTIONS
THE UNITED STATES IN 1850
LEGAL BASE
THE CONSTITUTION
EXECUTIVE POWER
PRESIDENT DIRECTLY ELECTED – ELECTORAL COLLEGE AND POPULAR VOTE SYSTEM
LEGISLATIVE POWER
REPRESENTATIVES DIRECTLY ELECTED
SENATORS INDIRECTLY ELECTED
RESTRICTED VOTE
RACIAL AND SEX RESTRICTIONS
THE UNITED STATES TODAY
LEGAL BASE
THE CONSTITUTION
EXECUTIVE POWER
PRESIDENT DIRECTLY ELECTED — ELECTORAL COLLEGE AND POPULAR VOTE SYSTEM
LEGISLATIVE POWER
REPRESENTATIVES AND SENATORS DIRECTLY ELECTED
UNIVERSAL VOTE
ADULT CITIZENS

Chart by Graphics Institute, N.Y.C.

tion overcame this difficulty. It is true, however, that there was a long controversy between those Americans who supported a strong central government and those who believed that the states should be able to ignore Federal laws. The victory of the Federal Government in the War between the States settled the issue in favor of a strong national union. The success of federalism in the United States has led to its adoption by a number of other countries.

In a federal system there is a division of powers between the central government and the self-governing states. In the United States the central government has charge of foreign affairs, including the negotiating of treaties and the making of war and peace; the armed forces for the common defense; commerce with foreign nations and among the states; citizenship and naturalization; the coinage of money; and the postal system. The central government may levy import duties and excise taxes, and it may impose other taxes, including taxes on income and inheritance (see TAX). It may prosecute persons who violate Federal law.

Just as the central government is supreme within the limits of its powers, so the states are supreme within the limits of theirs. Under the Tenth Amendment to the Constitution the central government has only those powers stated in that document, while the powers belonging to the states or to the people are those powers that are not definitely given to the central government. The states deal with matters of state commerce and property, social welfare, education, marriage and divorce, public highways, crimes against persons and property, and other matters within their borders. They may not enter into any treaty or alliance or confederation; coin money or issue bills of credit; lay any imposts or duties on imports or exports without the consent of Congress, except what may be necessary for executing their inspection laws; or keep troops or ships of war in time of peace without the consent of Congress. If either

ABOVE, SIGNERS OF THE DECLARATION OF INDEPENDENCE. BELOW, MAKERS OF THE CONSTITUTION.

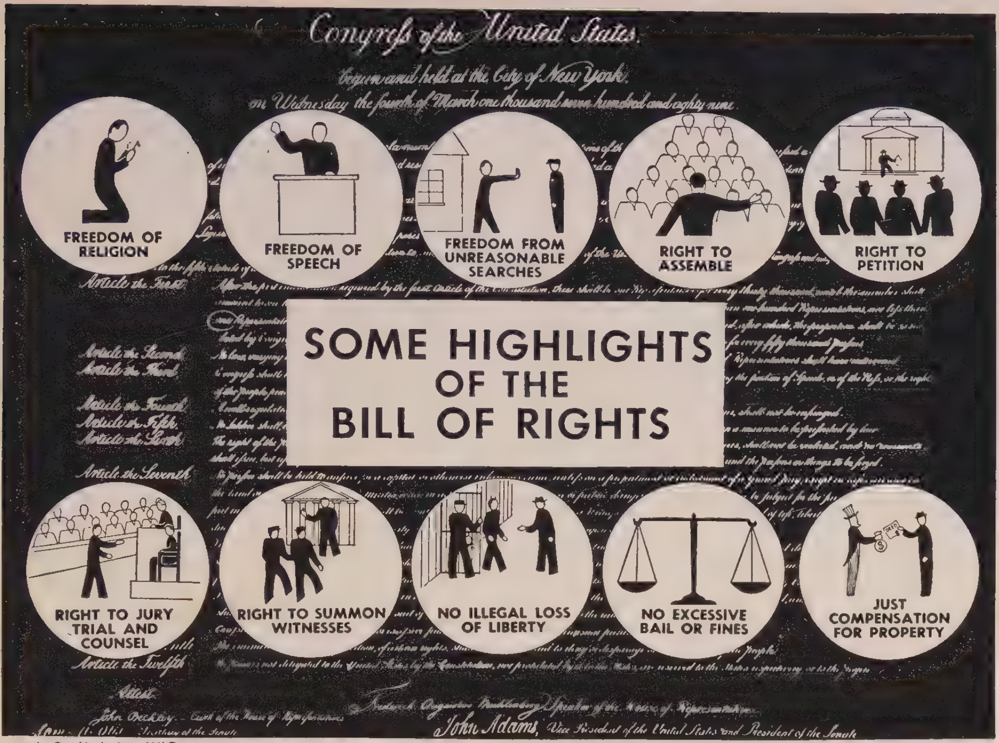

Congreſs of the United States,
begun and held at the City of New York,
on Wednesday the fourth of March one thousand seven hundred and eighty nine.
FREEDOM OF RELIGION
FREEDOM OF SPEECH
FREEDOM FROM UNREASONABLE SEARCHES
RIGHT TO ASSEMBLE
RIGHT TO PETITION
SOME HIGHLIGHTS OF THE BILL OF RIGHTS
Article the First
Article the Second
Article the Third
Article the Fourth
Article the Fifth
Article the Sixth
Article the Seventh
RIGHT TO JURY TRIAL AND COUNSEL
RIGHT TO SUMMON WITNESSES
NO ILLEGAL LOSS OF LIBERTY
NO EXCESSIVE BAIL OR FINES
JUST COMPENSATION FOR PROPERTY
Article the Twelfth
Attest,
John Beckley, Clerk of the House of Representatives.
Sam. A. Otis Secretary of the Senate.
Frederick Augustus Muhlenberg Speaker of the House of Representatives.
John Adams, Vice President of the United States, and President of the Senate.

Chart by Graphics Institute, N.Y.C.

the central government or a state attempts to exercise any power reserved to the other, or any prohibited power, the Supreme Court may declare such action unconstitutional.

Other Features of American Government. The republican form of government is the second important feature. The Fathers of the Constitution took a daring step when they provided that the head of the government be elected (see ELECTORAL COLLEGE). Many Europeans predicted that the American Republic would fail and be replaced by a monarchy. But when the experiment proved successful, other countries began to replace their hereditary rulers with elected executives.

Government by the people is a third feature. American democracy has been a gradual development. The men who drafted the Constitution set up a republic, but they did not believe in rule by all the people. Most of the male adults were prevented from voting because they could not meet the requirements regarding education and ownership of property. But a new spirit of freedom and equality developed on the frontier, and as the new Western states entered the Union, they demanded that all men be allowed to vote. In 1920, through the adoption of the Nineteenth Amendment, women acquired equality with men in voting, throughout the nation.

The written constitution, another American invention, is a fourth feature of American government. The purpose of the Constitution is to define the powers of the government and to prevent it from interfering with the rights of the people. The great merit of a written constitution is that it sets up a government of laws and not a government of men. Today Great Britain is one of the few countries having no single written constitution (see GREAT BRITAIN, *Government*).

The Bill of Rights, guaranteeing the liberties and privileges of the people and protecting them against tyranny, is a fifth feature (see BILL OF RIGHTS).

The separation of powers in government, still another American invention, is a sixth feature. Under this doctrine the great powers of government are divided among three great branches — legislative, executive, and judicial. In general the legislature (Congress) makes the laws, the executive (the President) enforces them, and the judiciary (the Supreme Court) interprets and applies them. This separation prevents any single body or person from holding control. By contrast, most European countries concentrate power in their parliaments.

The system of checks and balances is a seventh feature. Congress has two houses so that each chamber may act as a check on the other. The President has a check on Congress in his veto power. The Supreme Court may declare unconstitutional both Congressional laws and presidential acts. Constitutional provisions serve as checks on all government agencies in order to protect the people. Other constitutional provisions serve to protect the minority by providing checks on the majority.

A strong President is an eighth feature. The President of the United States is elected by the people, he is independent of Congress, and he has great powers in his own right. Most republics outside the Americas have a weak President who serves as head of the state but has little authority; the real power is in the hands of a chief minister as head of the government. In the United States the President is both head of the state and head of the government.

Most of the administrative work of the Federal Government is organized in ten executive departments, whose heads are the members of the President's Cabinet. They serve under the direct control of the President and are responsible to him. Each department is subdivided into numerous offices, divisions, and bureaus. The executive branch also has numerous independent agencies. Their top officials are nominated by the President and confirmed by the Senate, but in operation the agencies are independent of both the President and Congress. Full treatment of the three branches of the government is given in these volumes in the following articles: CABINET and those on the ten executive departments; CONGRESS OF THE UNITED STATES; COURT; PRESIDENT OF THE UNITED STATES; REPRESENTATIVES, HOUSE OF; SENATE OF THE UNITED STATES; SUPREME COURT OF THE UNITED STATES.

State Government. Under the federal system the states have all the powers of sovereign countries except those powers given to the central government and those denied the states in the Constitution. The chief features of the central government are found in the states: a republican form of government, popular rule, a written constitution, a bill of rights, separation of powers, checks and balances, and a strong executive. All the states have a two-house (bicameral) legislature except Nebraska, which has a one-house (unicameral) legislature. Every state has an elected governor as executive, and most states have a lieutenant governor who succeeds the governor if he dies in office or is removed from office. In every state except North Carolina the governor may veto legislation, but the legislature can pass laws over his veto. Although the governor nominates many state officials, he usually has far less power to appoint than the President. As a rule the judges and the principal administrative officials, such as the secretary of state, the treasurer, the attorney general, and the superintendent of public instruction, are elected directly by the people.

In the states the names of the courts and their organization vary widely. In general, as in the federal system, there are three levels — a state supreme court, intermediate courts of appeals, and the ordinary trial courts. In most cases the state supreme court has the final decision, but certain types of cases can be carried directly from it to the United States Supreme Court.

Local Government. Three different forms of local government have developed in the United States. In New England, local government has always centered around the town, which elsewhere is called the township. Since early colonial times local officials in New England have been elected at annual town meetings open to all eligible voters. This example of pure democracy, however, is giving way to representative government as the population increases. In Virginia and other Southern states the county developed as the most common unit of local government. In the colonies between New England and Virginia the two forms were combined in a mixed, or county-township, system. In general the Midwest adopted the mixed system and the Far West the county system (see COUNTY; TOWNSHIP). City government is the most important form of local government. Each city has a "home rule" charter drafted by the city itself or a special charter drafted by the state legislature, or it operates under state laws applying to city government in general (see ALDERMAN; CITY; CITY MANAGER; COMMISSION FORM OF GOVERNMENT; MAYOR; POLICE).

Territorial Government. Outside of the original thirteen states, most of America was once public domain of the United States. When people began to settle in the western lands, Congress set up territories to provide civil government. The first organized territory, the Northwest Territory, was later subdivided into smaller territories which eventually became five Midwestern states. Elsewhere this process was repeated many times. In American history the territory has been a step in the making of a new state. The last of the present states to enter the Union were New Mexico and Arizona, which were admitted in 1912 (see TERRITORY).

In Alaska and Hawaii, now the only incorporated territories of the United States, the people elect the legislature, but the governor is appointed by the President. Each territory is represented in Congress by a delegate who may take part in debate but may not vote. Both Alaska and Hawaii have asked to be admitted to the Union.

Outlying Possessions are governed in various ways. Puerto Rico has full local self-government. The Virgin Islands and Guam elect their own legislatures, but their governors are appointed by the President. Samoa, the Panama Canal Zone, and the Trust Territory of the Pacific Islands, administered by the United States since World War II under a United Nations trusteeship, have governors appointed by the President (see TRUSTEESHIP). The Panama Canal Zone is not under American sovereignty but is under the occupation and control of the United States. Besides the Territory of the Pacific Islands, a number of small islands in the Pacific, including Wake and Midway, are under American sovereignty.

History

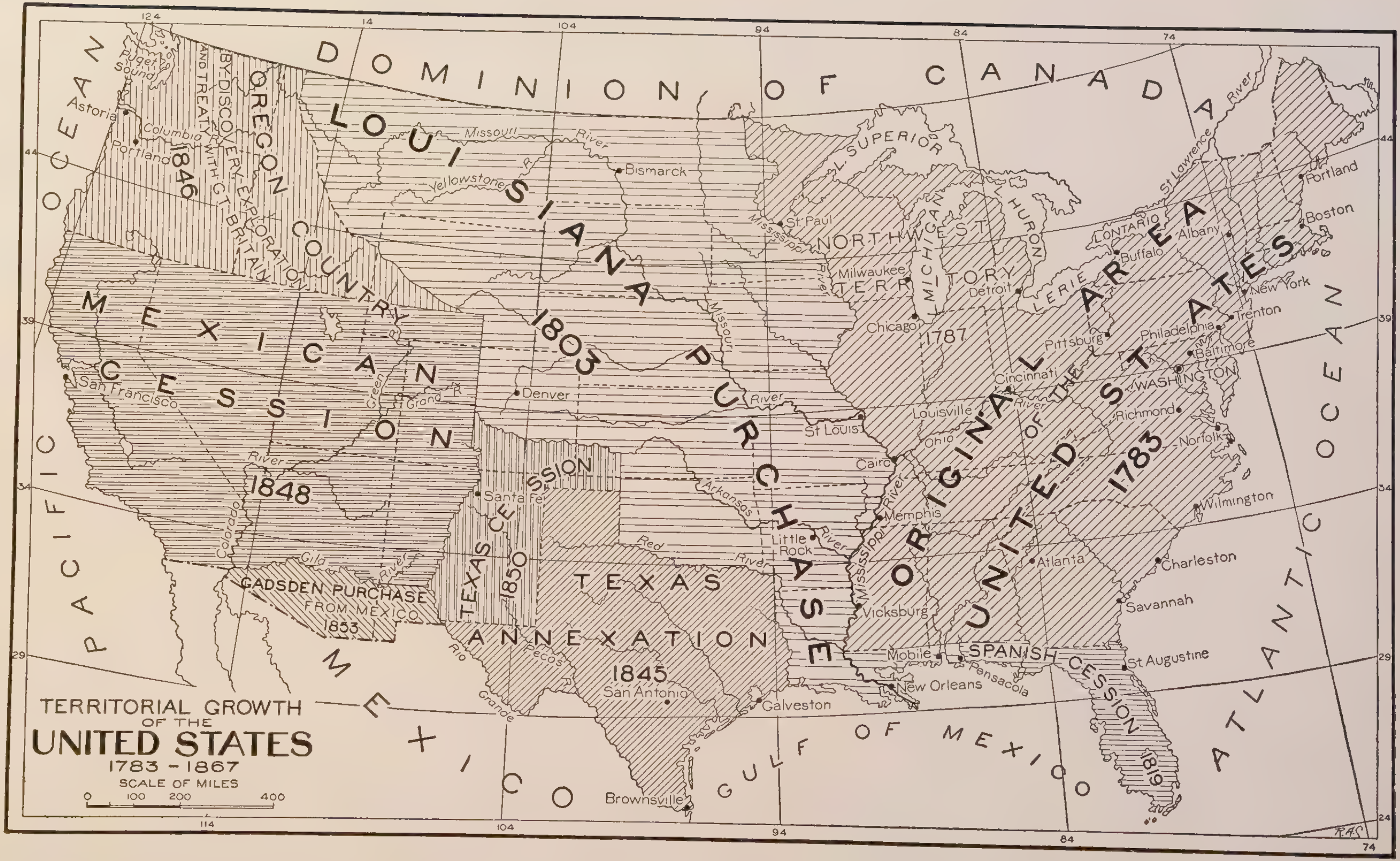
Discovery and Exploration. The European sailors who first crossed the Atlantic Ocean to the New World were seeking a sea route to Asia. Since the Crusades, Europeans had grown ever fonder of the spices, silks, and other products of the Far East, which were brought westward to the Mediterranean and then shipped to European cities. Italian cities controlled the commerce on the Mediterranean, and the nations of western Europe were jealous of the Italians' profits. In their search for some way to get a share of the commerce, they turned to the Atlantic Ocean. Portuguese navigators sailed southward along the African coast and finally rounded Africa's southern tip and sailed on to India (see GAMA, VASCO DA). The Italian navigator Christopher Columbus, leading an expedition financed by the rulers of Spain, sailed westward and reached the New World in 1492 (see COLUMBUS, CHRISTOPHER).

Then followed great numbers of Spanish adventurers (see CORONADO, FRANCISCO VÁSQUEZ DE; DE SOTO, HERNANDO; PONCE DE LEÓN, JUAN). Before long the newcomers realized that the lands they had found were not parts of the Orient, but the gold and silver they found encouraged them to explore more and more of the new territories. The Spaniards moved to the islands of the Caribbean, into Central America, and into coastal areas of South America, established colonies, and set up a steady flow of shipping between the New World and the Old. Even in these earliest days America represented the Land of Opportunity to Europe. The wealth of its mines was the first great attraction, but it also offered new sights and sounds, new foods and new plants, new peoples and new languages. For centuries the New World, with its great open spaces, was to offer a chance for a new start to the young, the brave, and the freedom-loving men and women of the Old World. See COLONIES AND COLONIZATION.

John Cabot, another Italian navigator, explored part of the coastline of North America for the English Crown in 1497. Like Columbus, he was searching for a route to the Indies (see CABOT). In the first half of the sixteenth century, French explorers also reached the North American shores. But while the Portuguese established a colony in Brazil, Spain continued to be the great power in the New World. The lands visited by the British and French did not offer the riches of more southerly regions, and even after England had proved itself to be the master of Spanish sea power in 1588, when the English defeated the Spanish Armada (see ARMADA), there was no rush of colonists to the North American coast.

The first successful English settlement was made at Jamestown, Va., in 1607 (see JAMESTOWN). The cultivation of tobacco, rather than the mining of gold and silver, finally brought prosperity to this settlement of pioneers. In 1620 the English Pilgrims landed at Plymouth to found a new home where they could worship as they pleased, and a few years later the Puritans established Massachusetts Bay Colony for the same purpose (see PILGRIMS; PLYMOUTH COLONY; MASSACHUSETTS BAY COLONY). Harsh religious laws at home drove thousands of refugees to this "New England," and other colonies were settled. By the end of the colonial period New England consisted of Massachusetts, which had absorbed Plymouth, and Connecticut, Rhode Island, and New Hampshire. Maine was a part of Massachusetts, and both New Hampshire and New York claimed Vermont. (Important events in the history of the states are treated in the state articles.)

A group of colonies grew up between the settlements in New England and those in Virginia, where many Royalists, or Cavaliers, had made their homes after the defeat of Charles I in the English Civil War (see ENGLAND, *History*). In 1664 the English seized the colony of New Netherland, which the Dutch had established on the Hudson River, and renamed it New York in honor of the Duke of York. In the same year the English took over the colony on the Delaware which the Dutch had captured from the original Swedish settlers. This colony, which became known as Delaware, was given a separate government but was considered a part of the region controlled by William Penn, who colonized Pennsylvania in 1682 as a refuge for Quakers and members of other religious sects that were persecuted in Europe (see PENN, WILLIAM). Religious freedom was also granted in Maryland, which was founded in 1634 by Lord Baltimore as a haven for persecuted Roman


TERRITORIAL GROWTH OF THE UNITED STATES 1783 - 1867

Catholics (see BALTIMORE, GEORGE CALVERT, LORD).

North Carolina and South Carolina were originally a single colony, with eight English nobles as its directors. Early settlers there included Huguenots driven from France (see HUGUENOTS), Scotch-Irish from northern Ireland, and people from Virginia. The youngest of the thirteen original colonies was Georgia, which was founded in 1733 by a group headed by James Oglethorpe (see OGLETHORPE, JAMES EDWARD), who offered a new home to English debtors and to Protestants unwelcome in their native land.

The American Colonies. It is easy to see that religious liberty was one of the important blessings offered by the English colonies to the Europeans who braved the Atlantic and the danger and discomfort of a strange, primitive region to settle there. But an even greater attraction to many was the cheap land. In their old homes they could hope for nothing better than the right to rent the small fields their ancestors had worked for generations. In the New World, land was practically free to any man willing to do the work of clearing off the trees and underbrush. Farming naturally became the chief occupation of the settlers and remained so throughout the centuries of expansion to the west. Fishing and shipping, as well as agriculture, were important in New England; many different crops were raised in the middle colonies farther south; and in the region from Maryland to Georgia, tobacco, rice, and indigo were raised on large plantations, worked by Negro slaves. Boston, New York, Philadelphia, and Charleston (S. C.) were the chief cities.

Actually, cheap land was far more common than religious freedom in colonial America. The Puritan Church controlled most of New England, and the Anglican Church, whose leaders had belonged to the Church of England, was all-powerful in the South. Only in such colonies as Rhode Island and Pennsylvania were men free to worship as they pleased and still enjoy all rights and privileges. Gradually, however, as various religious groups gained strength, the movement for full religious freedom spread through the colonies. This movement was natural in a land where self-government quickly gained ground. In the local communities the people managed their own affairs — through the town, or township, in New England, through the county in the southern colonies, and through combined counties and townships in the middle colonies. Connecticut and Rhode Island, which had charters from the British Crown, governed themselves almost completely (see CHARTER; CHARTER OAK). The other colonies had elected assemblies. But colonial America was a limited democracy. In New England, government was in the hands of the church leaders; in the South it was controlled by the wealthy plantation owners. Democracy in a broad sense grew up as a result of the spirit of independence and equality which was a part of life on the frontier. In the New World, where everyone had to make his own way, the European idea that one class should rule and the other be ruled no longer seemed natural or just.

During most of the period from 1600 to 1700 the English Government had so many problems at home that it permitted the colonies to manage their own affairs with little interference. This policy was continued during the long years of wars, both in Europe and in America, between the French and the English (see FRENCH AND INDIAN WARS). In these wars the American colonists gained military experience and a feeling of independent power. In 1754 a union of the colonies for common defense was discussed at Albany (see ALBANY CONGRESS). In 1763 the English won final victory over the French in the New World (see QUEBEC, BATTLE OF).

The War for Independence. With the French no longer threatening, the American colonists felt even more self-reliant and less dependent on England. But now England was determined to place the colonies under firmer controls. England, like other European powers, believed that the whole purpose of colonies was to serve the mother country, accepting whatever rights the mother country gave them and asking nothing. In practice, the American colonies had generally ignored those laws which England laid down to control colonial commerce and industry for the benefit of England. But after 1763 England took steps to enforce the old laws and also levied taxes on the colonists to force them to help support British troops stationed in America.

The Stamp Act of 1765, imposing a tax of this type, stirred up the famous cry, "Taxation without representation is tyranny!" Most Americans refused to buy the stamps, and there was a movement to stop importing British goods. Although Britain's Parliament repealed the act, it insisted on its right to tax the colonies and in 1767 placed duties on certain goods the colonies imported. The trouble stirred up by such attempts to tax the colonists and by the stationing of British troops in colonial cities resulted in the Boston Massacre of 1770, in which five Americans were killed by British soldiers; the resentment of the colonists also led to the Boston Tea Party (1773), in which defiant Americans dumped a cargo of tea into the harbor in protest against the tea tax. Every attempt by Eng-

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THE MEN WHO ANSWERED THE CALL of Paul Revere are not so famous as that dramatic messenger, but each one represented the spirit of courage, determination, and independence which enabled the colonies to fight their way to freedom.

land to punish rebellious colonists brought even more colonists into the struggle. Colonial leaders met together and exchanged messages, uniting the various sections in the fight for what the colonists believed was simple justice. See BOSTON MASSACRE; BOSTON TEA PARTY; COMMITTEES OF CORRESPONDENCE; INTOLERABLE ACTS; STAMP ACT.

On September 5, 1774, the First Continental Congress took steps to shut off the importation of British goods. In Massachusetts the "minutemen" were organized to resist British military action (see MINUTEMEN). The first clash came on April 19, 1775 (see LEXINGTON, BATTLE OF), and the aroused minutemen then besieged the British army under General Gage at Boston. The Second Continental Congress voted to support Massachusetts and made George Washington commander of the Continental Army. The American Revolution was under way.

At first few Americans wished to break away from the mother country. They looked upon themselves as Englishmen, fighting for the rights that all Englishmen should enjoy. But once the dispute over taxes had been turned into a war, the struggle for justice soon became a fight for freedom. The Continental Congress became the central government, and revolutionary governments were set up in all the colonies. On July 4, 1776, the Declaration of Independence was adopted (see DECLARATION OF INDEPENDENCE).

In the Revolutionary War the American side was weakened by the fact that its central government had little authority. The British won most of the battles, but they could neither destroy nor capture Washington's little army. The turning point of the war came in October, 1777, when the Americans defeated and captured General Burgoyne's British army near Saratoga, N. Y. French forces were sent to aid the

SKF Industries, Inc.

Benjamin Franklin, Printer of Philadelphia

[See Franklin, Benjamin]

tiersmen, men who could lick their weight in wildcats, sharpshooters with the long rifle — these were the men who pushed back the frontier. They had the urge to get going, to see what lay on the other side of mountains and plains. Behind them came the settler's wagons, loaded with household goods, with ax, seed, and plow.

Americans, and the fighting ended at Yorktown, Va., on October 19, 1781, when England's General Cornwallis was forced to surrender to the American and French troops. In the treaty of peace, signed at Paris on September 3, 1783 (see PARIS, TREATIES OF), England recognized the independence of the United States. (For chief battles and the course of events, see REVOLUTIONARY WAR IN AMERICA.)

From Confederation to Constitution. Then followed what has been called the "critical period" in American history. The thirteen colonies had worked together to win independence, but now that they were free, there was little to hold them together. Each one wanted to run its own affairs in its own way. The central government set up under the Articles of Confederation in 1781 had little real power, because the men who established it were in rebellion against government control (see CONFEDERATION, ARTICLES OF). Congress could not levy taxes; it could only ask the states for money. No changes could be made in the Articles of Confederation unless all the states agreed to them, and the states were seldom in complete agreement. A major action taken by Congress was the adoption of the Ordinance of 1787. This famous Ordinance provided that the land lying between the Great Lakes, the Ohio River, and the Mississippi, known as the Northwest Territory, should be organized into self-governing territories which would later become states (see ORDINANCE OF 1787).

The weak government faced very difficult times. Separation from England caused America to lose much of its shipping business, and jobs and money became scarce. Freedom did not bring prosperity, and the poorer people blamed the wealthy class and the public officials for their troubles. In Massachusetts their discontent led to an uprising known as Shays' Rebellion (see SHAYS' REBELLION). Fearing such signs of violence, the well-to-do businessmen and professional men began a movement for a strong central government that could establish law and order. In May, 1787, the Constitutional Convention met in Philadelphia.

George Washington was chosen as president of the convention, which was attended by such leading citizens as Benjamin Franklin, Alexander Hamilton, and James Madison. The convention quickly decided to draft a new constitution to replace the Articles of Confederation. Many disagreements arose, especially between the large states and the small, but by compromise all differences were settled. The completed Constitution provided for a federal union — the first of its kind in history. Then came the task of persuading the states to accept the new system of government. The *Federalist* papers were written by Hamilton, Madison, and John Jay to explain the benefits of the Constitution (see FEDERALIST, THE), and it was finally ratified, though North Carolina and Rhode Island delayed their approval until after the new government was set in motion in 1789. See CONSTITUTION OF THE UNITED STATES.

Organizing the Federal Government. George Washington was the first President, and John Adams was Vice-President. Congress first met on April 6, 1789, in New York. The government began operation with a few clerks, an empty treasury, and many debts. Congress gradually put the new system to work and secured funds by means of a tariff on imports. The President organized the Federal administration. His chief advisers were men of very different political views — Hamilton, the Secretary of the Treasury, and Jefferson, the Secretary of State.

The credit of the new government was established by Hamilton's financial program, which was supported by the well-to-do citizens and opposed by those who were poor and in debt. The well-to-do believed with Hamilton that the country needed a powerful central government and a strict, conservative economic policy. His supporters called themselves Federalists and represented the administration party in politics. The poorer people believed that Hamilton intended to use the government to aid the wealthy; they considered him an enemy of democracy, whose policies increased their troubles (see HAMILTON, ALEXANDER).

These opponents of the administration were first known as the Anti-Federalists. Out of this group came the Republicans, later known as Democratic-Republicans, and finally as Democrats. Their leader, Thomas Jefferson, resigned from the Cabinet in 1793 to push the fight against the Federalists. See ANTI-FEDERALISTS; DEMOCRATIC-REPUBLICAN PARTY; FEDERAL PARTY.

The two groups were sharply divided over the French Revolution, which broke out in 1790 and led to the overthrow of monarchy in France (see FRENCH REVOLUTION). Jefferson's followers sympathized with the Revolutionists but the Federalists looked upon them as dangerous radicals. When France went to war with England, Jefferson's followers supported the French, and the Federalists sided with the British. Even though the United States had a treaty of alliance with France, President Washington kept America neutral. American shipping earned large profits in the wartime trade, but the two warring powers constantly interfered with American commerce.

During his second term Washington called out the militia to put down a rebellion against the whisky tax in western Pennsylvania (see WHISKY INSURRECTION) and sent General "Mad" Anthony Wayne to crush an Indian uprising in the Northwest Territory. John Jay helped to arrange a treaty in 1794 under which the British gave up the forts they had retained in the old Northwest (see JAY'S TREATY), and in 1795 a treaty with Spain gave Americans the right to navigate the Mississippi. These two treaties hastened America's movement westward.

Three new states were admitted to the Union: Vermont in 1791, Kentucky in 1792, and Tennessee in 1796. The pioneers in these areas were natural supporters of Jefferson's democratic policies. In 1796 Washington delivered his Farewell Address, announcing his decision to retire from public life at the close of his term of office (see WASHINGTON, GEORGE). The Federalist candidate, John Adams, was elected President. His opponent, Jefferson, received the second largest number of electoral votes and became Vice-President (see ADAMS, JOHN).

Under Adams the United States became involved in an undeclared naval war with France. The Federalists lost their popularity when they sought to silence their critics with the Alien and Sedition Laws. These acts led to the drawing up of the Kentucky and Virginia Resolutions, which defended the rights of the states and hinted that the states might reject unpopular laws passed by the Federal Government (see ALIEN AND SEDITION LAWS; KENTUCKY AND VIRGINIA RESOLUTIONS; NULLIFICATION). Adams was defeated in the election of 1800, and Jefferson, tied for first place with Aaron Burr, became President when the House of Representatives decided in his favor (see JEFFERSON, THOMAS).

AMERICA WAS BUILT ON CO-OPERATION. From colonial times, neighbors pitched in at "barn-raisings," helping one another to establish homes and make their way in the new land.

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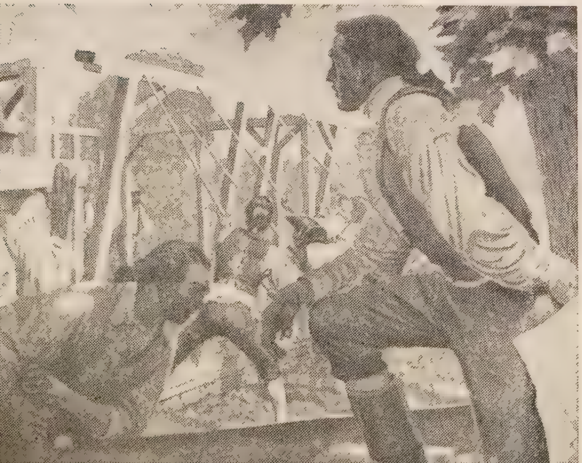


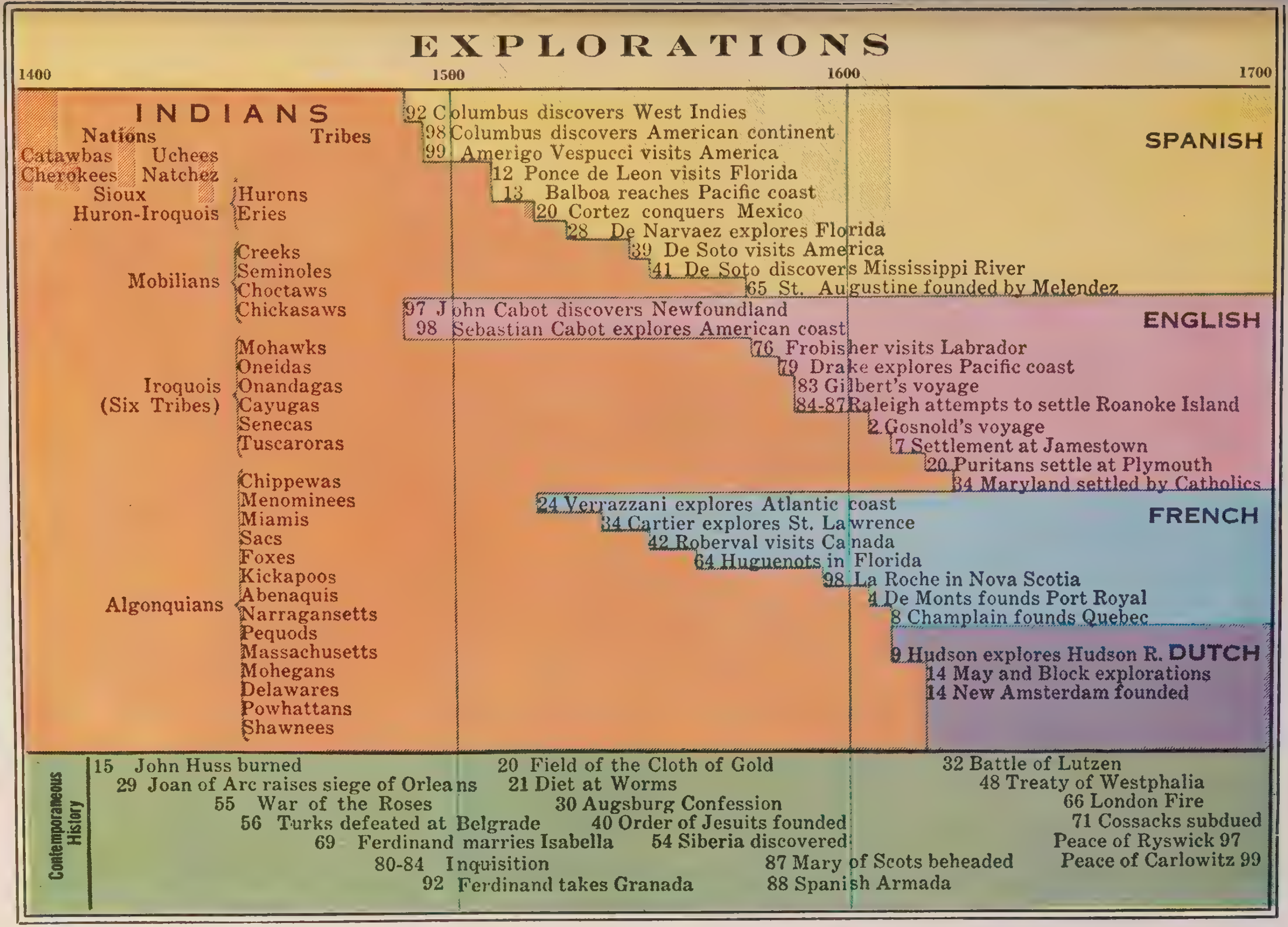
Jeffersonian Democracy. Jefferson's election brought about the first period of American democracy. The new President had deep faith in the common people, especially the farmers from whom he drew most of his support. He believed that the Constitution should be followed to the letter so that the powers of the central government would be strictly limited. In his attempts to reform the government in accordance with his own principles he was himself checked to some extent by Chief Justice John Marshall and other Federalist judges.

The major event of Jefferson's first term was the purchase from France of Louisiana, an enormous territory now divided into thirteen states. The President approved this action even though he believed it was unconstitutional, and he sent the Lewis and Clark Expedition to explore the region (see LEWIS AND CLARK EXPEDITION; LOUISIANA PURCHASE). In foreign affairs he avoided war but sent American forces against the pirates of Tripoli. He was easily victorious over the Federalist candidate in the campaign of 1804.

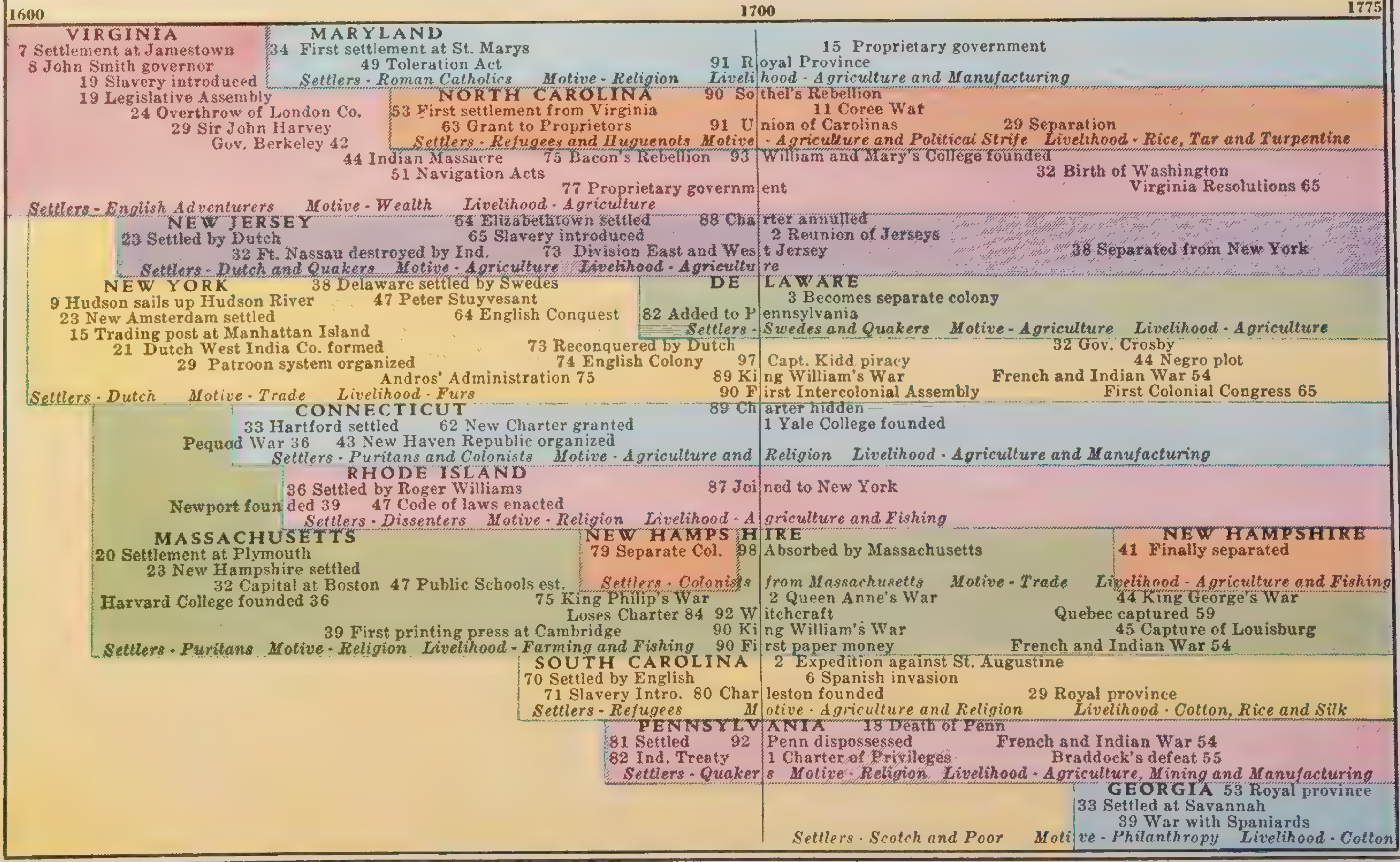
The War of 1812. The long conflict between England and France caused America great difficulty during Jefferson's second term. Each side blockaded the other's ports, and neutral ships caught trying to slip through the blockade were seized. The British repeatedly stopped American ships to remove sailors of British nationality. Hoping to avoid war, Jefferson in 1807 had Congress pass the Embargo Act (see EMBARGO), which made it illegal for American ships to sail from home ports to foreign ports. This act hampered the shipping industry so much that the embargo was removed in 1809 and replaced by the Nonintercourse Act, which banned commerce between the United States and the warring powers abroad.

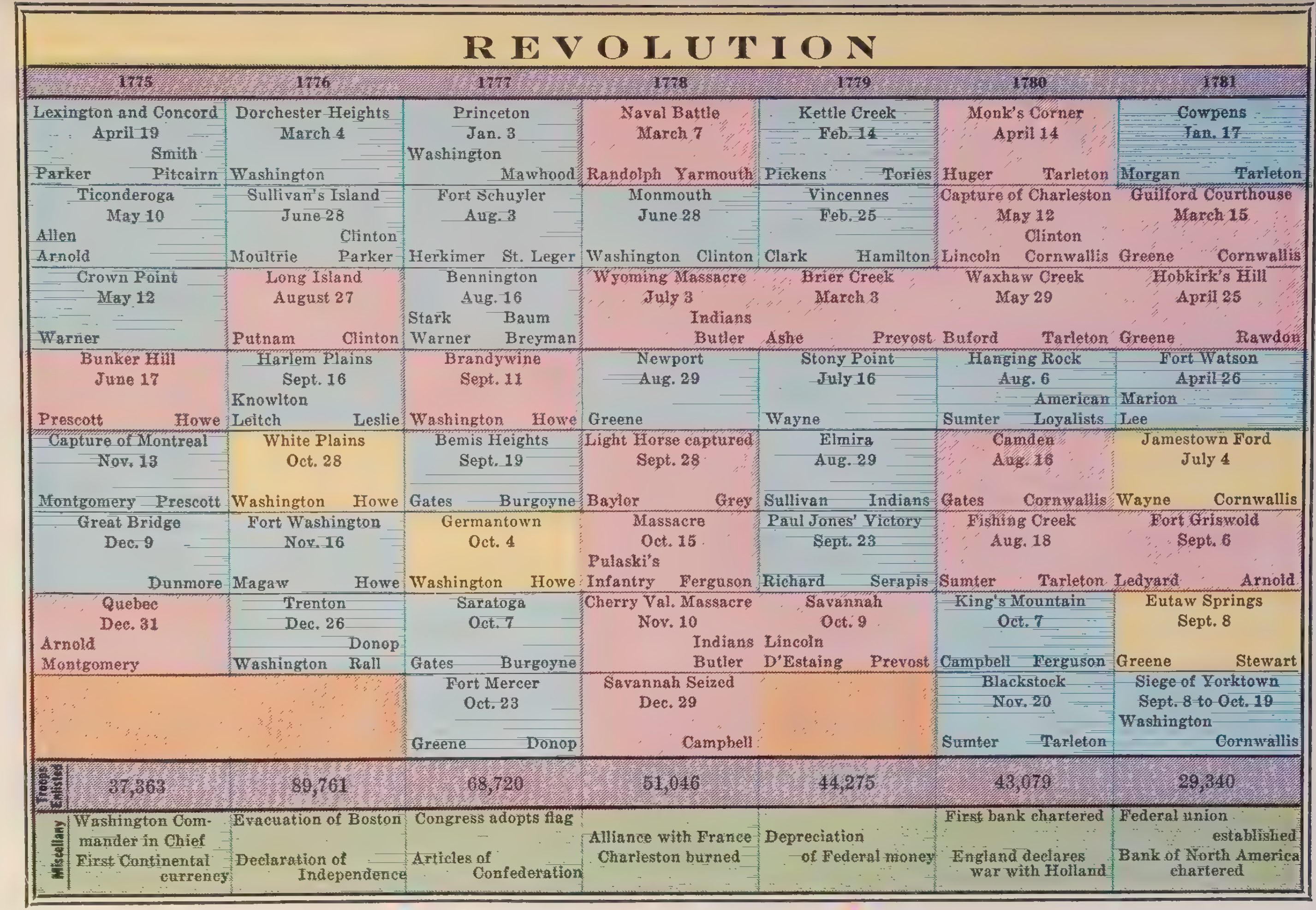
James Madison, Jefferson's Secretary of State, defeated the Federalist candidate in the presidential election of 1808. Madison worked for peace, but he was pushed steadily toward war by the "war hawks," representatives from the Western states who hoped America would seize Canada. On June 18, 1812, the United States finally declared war on Great Britain. In the conflict which followed, known as the War of 1812, neither side could win any important victories in the fighting along the Canadian border. After early American naval successes, the British navy blockaded the American coast, raided Washington, D. C., and burned the public buildings of the capital. The outstanding American victory was won by Andrew Jackson at New Orleans after the signing of the peace treaty.

The Federalists strongly opposed the war and made it their chief issue in the election


EXPLORATIONS
1400
1500
1600
1700
INDIANS
Nations
Tribes
Catawbas
Uchees
Cherokees
Natchez
Sioux
Huron-Iroquois
Hurons
Eries
Mobilians
Creeks
Seminoles
Choctaws
Chickasaws
Iroquois (Six Tribes)
Mohawks
Oneidas
Onandagas
Cayugas
Senecas
Tuscaroras
Algonquians
Chippewas
Menominees
Miamis
Sacs
Foxes
Kickapoos
Abenaquis
Narragansetts
Pequods
Massachusetts
Mohegans
Delawares
Powhattans
Shawnees
SPANISH
92 Columbus discovers West Indies
98 Columbus discovers American continent
99 Amerigo Vespucci visits America
12 Ponce de Leon visits Florida
13 Balboa reaches Pacific coast
20 Cortez conquers Mexico
28 De Narvaez explores Florida
39 De Soto visits America
41 De Soto discovers Mississippi River
65 St. Augustine founded by Melendez
ENGLISH
97 John Cabot discovers Newfoundland
98 Sebastian Cabot explores American coast
76 Frobisher visits Labrador
79 Drake explores Pacific coast
83 Gilbert's voyage
84-87 Raleigh attempts to settle Roanoke Island
2 Gosnold's voyage
7 Settlement at Jamestown
20 Puritans settle at Plymouth
34 Maryland settled by Catholics
FRENCH
24 Verrazzani explores Atlantic coast
34 Cartier explores St. Lawrence
42 Roberval visits Canada
64 Huguenots in Florida
98 La Roche in Nova Scotia
4 De Monts founds Port Royal
8 Champlain founds Quebec
DUTCH
9 Hudson explores Hudson R.
14 May and Block explorations
14 New Amsterdam founded
Contemporaneous History
15 John Huss burned
29 Joan of Arc raises siege of Orleans
55 War of the Roses
56 Turks defeated at Belgrade
69 Ferdinand marries Isabella
80-84 Inquisition
92 Ferdinand takes Granada
20 Field of the Cloth of Gold
21 Diet at Worms
30 Augsburg Confession
40 Order of Jesuits founded
54 Siberia discovered
87 Mary of Scots beheaded
88 Spanish Armada
32 Battle of Lutzen
48 Treaty of Westphalia
66 London Fire
71 Cossacks subdued
Peace of Ryswick 97
Peace of Carlowitz 99

COLONIES


1600
1700
1775
VIRGINIA
7 Settlement at Jamestown
8 John Smith governor
19 Slavery introduced
19 Legislative Assembly
24 Overthrow of London Co.
29 Sir John Harvey
Gov. Berkeley 42
44 Indian Massacre
75 Bacon's Rebellion
93 William and Mary's College founded
51 Navigation Acts
77 Proprietary government
32 Birth of Washington
Virginia Resolutions 65
Settlers - English Adventurers
Motive - Wealth
Livelihood - Agriculture
MARYLAND
34 First settlement at St. Marys
49 Toleration Act
91 Royal Province
15 Proprietary government
Settlers - Roman Catholics
Motive - Religion
Livelihood - Agriculture and Manufacturing
NORTH CAROLINA
53 First settlement from Virginia
63 Grant to Proprietors
90 Sothel's Rebellion
11 Coree War
91 Union of Carolinas
29 Separation
Settlers - Refugees and Huguenots
Motive - Agriculture and Political Strife
Livelihood - Rice, Tar and Turpentine
NEW JERSEY
23 Settled by Dutch
32 Ft. Nassau destroyed by Ind.
64 Elizabethtown settled
65 Slavery introduced
73 Division East and West Jersey
88 Charter annulled
2 Reunion of Jerseys
38 Separated from New York
Settlers - Dutch and Quakers
Motive - Agriculture
Livelihood - Agriculture
NEW YORK
9 Hudson sails up Hudson River
23 New Amsterdam settled
15 Trading post at Manhattan Island
21 Dutch West India Co. formed
29 Patroon system organized
38 Delaware settled by Swedes
47 Peter Stuyvesant
64 English Conquest
73 Reconquered by Dutch
74 English Colony
Andros' Administration 75
97 Capt. Kidd piracy
89 King William's War
90 First Intercolonial Assembly
32 Gov. Crosby
44 Negro plot
French and Indian War 54
First Colonial Congress 65
Settlers - Dutch
Motive - Trade
Livelihood - Furs
DELAWARE
82 Added to Pennsylvania
3 Becomes separate colony
Settlers - Swedes and Quakers
Motive - Agriculture
Livelihood - Agriculture
CONNECTICUT
33 Hartford settled
Pequod War 36
43 New Haven Republic organized
62 New Charter granted
89 Charter hidden
1 Yale College founded
Settlers - Puritans and Colonists
Motive - Agriculture and Religion
Livelihood - Agriculture and Manufacturing
RHODE ISLAND
36 Settled by Roger Williams
Newport founded 39
47 Code of laws enacted
87 Joined to New York
Settlers - Dissenters
Motive - Religion
Livelihood - Agriculture and Fishing
MASSACHUSETTS
20 Settlement at Plymouth
23 New Hampshire settled
32 Capital at Boston
47 Public Schools est.
Harvard College founded 36
75 King Philip's War
Loses Charter 84
92 Witchcraft
39 First printing press at Cambridge
90 King William's War
90 First paper money
2 Queen Anne's War
44 King George's War
Quebec captured 59
45 Capture of Louisburg
French and Indian War 54
Settlers - Puritans
Motive - Religion
Livelihood - Farming and Fishing
NEW HAMPSHIRE
79 Separate Col.
98 Absorbed by Massachusetts
Settlers - Colonists from Massachusetts
Motive - Trade
Livelihood - Agriculture and Fishing
NEW HAMPSHIRE
41 Finally separated
SOUTH CAROLINA
70 Settled by English
71 Slavery Intro.
80 Charleston founded
2 Expedition against St. Augustine
6 Spanish invasion
29 Royal province
Settlers - Refugees
Motive - Agriculture and Religion
Livelihood - Cotton, Rice and Silk
PENNSYLVANIA
81 Settled
82 Ind. Treaty
92 Penn dispossessed
1 Charter of Privileges
18 Death of Penn
French and Indian War 54
Braddock's defeat 55
Settlers - Quakers
Motive - Religion
Livelihood - Agriculture, Mining and Manufacturing
GEORGIA
53 Royal province
33 Settled at Savannah
39 War with Spaniards
Settlers - Scotch and Poor
Motive - Philanthropy
Livelihood - Cotton



REVOLUTION

	1775	1776	1777	1778	1779	1780	1781
	Lexington and Concord April 19 Smith Parker Pitcairn	Dorchester Heights March 4 Washington	Princeton Jan. 3 Washington Mawhood	Naval Battle March 7 Randolph Yarmouth	Kettle Creek Feb. 14 Pickens Tories	Monk's Corner April 14 Huger Tarleton	Cowpens Jan. 17 Morgan Tarleton
	Ticonderoga May 10 Allen Arnold	Sullivan's Island June 28 Clinton Moultrie Parker	Fort Schuyler Aug. 3 Herkimer St. Leger	Monmouth June 28 Washington Clinton	Vincennes Feb. 25 Clark Hamilton	Capture of Charleston May 12 Clinton Lincoln Cornwallis	Guilford Courthouse March 15 Greene Cornwallis
	Crown Point May 12 Warner	Long Island August 27 Putnam Clinton	Bennington Aug. 16 Stark Baum Warner Breyman	Wyoming Massacre July 3 Indians Butler	Brier Creek March 3 Ashe Prevost	Waxhaw Creek May 29 Buford Tarleton	Hobkirk's Hill April 25 Greene Rawdon
	Bunker Hill June 17 Prescott Howe	Harlem Plains Sept. 16 Knowlton Leitch Leslie	Brandywine Sept. 11 Washington Howe	Newport Aug. 29 Greene	Stony Point July 16 Wayne	Hanging Rock Aug. 6 American Sumter Loyalists	Fort Watson April 26 Marion Lee
	Capture of Montreal Nov. 13 Montgomery Prescott	White Plains Oct. 28 Washington Howe	Bemis Heights Sept. 19 Gates Burgoyne	Light Horse captured Sept. 28 Baylor Grey	Elmira Aug. 29 Sullivan Indians	Camden Aug. 16 Gates Cornwallis	Jamestown Ford July 4 Wayne Cornwallis
	Great Bridge Dec. 9 Dunmore	Fort Washington Nov. 16 Magaw Howe	Germantown Oct. 4 Washington Howe	Massacre Oct. 15 Pulaski's Infantry Ferguson	Paul Jones' Victory Sept. 23 Richard Serapis	Fishing Creek Aug. 18 Sumter Tarleton	Fort Griswold Sept. 6 Ledyard Arnold
	Quebec Dec. 31 Arnold Montgomery	Trenton Dec. 26 Donop Washington Rall	Saratoga Oct. 7 Gates Burgoyne	Cherry Val. Massacre Nov. 10 Indians Butler	Savannah Oct. 9 Lincoln D'Estaing Prevost	King's Mountain Oct. 7 Campbell Ferguson	Eutaw Springs Sept. 8 Greene Stewart
			Fort Mercer Oct. 23 Greene Donop	Savannah Seized Dec. 29 Campbell		Blackstock Nov. 20 Sumter Tarleton	Siege of Yorktown Sept. 8 to Oct. 19 Washington Cornwallis
Troops Enlisted	37,363	89,761	68,720	51,046	44,275	43,079	29,340
Miscellany	Washington Commander in Chief First Continental currency	Evacuation of Boston Declaration of Independence	Congress adopts flag Articles of Confederation	Alliance with France Charleston burned	Depreciation of Federal money	First bank chartered England declares war with Holland	Federal union established Bank of North America chartered

🟦 AMERICANS 🟥 BRITISH 🟨 INDECISIVE

ADMINISTRATIONS

		1789	1797	1801	1809 1817
EXECUTIVE	President	WASHINGTON	ADAMS	JEFFERSON	MADISON
	Leaders in Cabinet	Jefferson Hamilton	Pickering Wolcott	Madison Dearborn	Gallatin Dallas
	Important Messages & Papers	Farewell Address		First Written Message	
JUDICIAL	Chief Justice	Jay	Ellsworth	Marshall	
	Decisions			Marbury and Madison	
LEGISLATIVE	Pres. of Senate	Adams	Jefferson	Burr Clinton	Clinton Gerry
	Speaker of House	Muhlenberg Trumbull Dayton	Sedgwick	Macon Varnum	Clay Cheves
	Number of Members	Senate 26 House 65	Senate 32 House 105	Senate 32 House 141	Senate 34 House 181
	Leaders	Madison Gerry	Clay	John Quincy Adams	Calhoun Webster
	Laws	Revenue Bill Naturalization Law	Alien and Sedition Acts	Embargo Act	Nonintercourse Act
IMPORTANT EVENTS	Wars	Indian Whisky Rebellion	Quasi	Tripoli	Indian War of 1812
	Inventions	Cotton gin Nail cutter	Locomotive Plow	Steamboat Blow pipe Steam dredge	Breech-loading rifle Printing of cotton goods
	Acquisition Territories			Louisiana	
	Foreign Relations	Treaty with England Treaty with Spain	Treaty with France		Treaty of Ghent
	Slavery	Petition to Abolish sent to Congress		Slave trade abolished	
	Deaths	Allen Franklin Hancock Jones	Henry Washington	Hamilton Samuel Adams Moultrie	Clinton Gerry
	States Admitted	Vermont Kentucky Tennessee		Ohio	Louisiana Indiana
	Miscellany	Census Capitol moved		Lewis & Clark Expedition West Point Academy	Washington burned
	Foreign Events	French Revolution		Milan Decree	Revolution in Venezuela Mexican Uprising

ADMINISTRATIONS

	1817	1825	1829	1837	1841	1845 1849
Pres.	MONROE	ADAMS	JACKSON	VAN BUREN	HARRISON TYLER	POLK
Cab't	Adams Calhoun	Clay Rush	Van Buren Livingston Berrien	Forsyth	Webster Calhoun	Buchanan
Mes-sages	Monroe Doctrine		Bank Message			
Chief Just.			Taney			
Deci-sions	Dartmouth College					
Pres. Senate	Tompkins	Calhoun	Calhoun Van Buren	Johnson		Dallas
Speak. House	Clay Taylor Barbour	Taylor	Stevenson Bell Polk	Hunter	White Jones	Davis Winthrop
No. Mem.	Senate 42 House 213	Senate 48 House 213	Senate 48 House 240	Senate 52 House 240	Senate 52 House 223	Senate 58 House 223
Lead-ers	Clay Webster Jackson	Van Buren Buchanan	Webster Clay Hayne Benton	Wright Adams		Wilmot Corwin
Laws	Tenure of Office Act		U. S. Bank Bill vetoed Force Act	Sub-Treasury Bill	Annexation Bill	Wilmot Proviso
Wars	Seminole		Black Hawk Seminole	Seminole	Dorr Rebellion	Mexican
Inven-tions	Shoe pegs Velocipede	Planing mach. Passenger train	Colt's revolver Typewriter Chloroform used	Friction match Elec. telegraph	Telegraph line Use of ether	Sewing machine Hoe ptg. press
Acqui-sitions	Florida					
For'n Rel.	Treaty with Canada		Treaty with Brazil		Webster-Ashburton	Treaty of Hidalgo
Slav-ery	Missouri Compromise	Slavery abolished in N. Y.	Anti-Slavery in New England	Anti-Slavery Party	Growth of Abolition	Wilmot Proviso
Deaths	Decatur Boone Stark	Adams Jefferson	Jay Monroe Madison Marshall	Black Hawk	Channing Jackson	J. Q. Adams
States Admit.	Mississippi Illinois Alabama Maine Missouri		Michigan Arkansas		Texas Florida	Iowa Wisconsin
Miscel-lany	First steam voyage across the Atlantic	First threshing machine	Rise of American literature	Indians removed to Indian Ter.	Postage stamps	Discovery of gold in Calif.
For'n Events	Mexican Revolution		Independence of Mexico Independence of Texas	Canadian Reb. Victoria Crown.	Federal Union in C. A. dissolved	

ADMINISTRATIONS

1849 1853 1857 1861 1869 1877 1881 1885

Pres.	Taylor Fillmore	Pierce	Buchanan	Lincoln Johnson	Grant	Hayes	Garfield Arthur
Cab't	Webster Meredith	Marcy Davis	Cass Dix	Seward McCulloch	Fish Sherman Brewster	Evarts Sherman	Blaine Lincoln
Messages			Revolutionary Message	Emancipation Proc. Amnesty			
Chief Just.				Chase	Waite		
Decisions							
Pres. Senate			Breckenridge	Hamlin	Colfax Wilson	Wheeler	
Speak. House	Cobb Boyd	Banks	Orr Pennington	Grow Colfax	Blaine Kerr Randall		Keifer Carlisle
No. Mems	Senate 62 House 237	Senate 62 House 237	Senate 66 House 243	Senate 50 House 243	Senate 74 House 293	Senate 76 House 293	Senate 76 House 332
Leaders	Douglas Davis	Cass Stephens	Seward Cameron	Stevens Sumner Morrell Crittenden	Morton Wilson Schurz Trumbull	Edmunds Bland	Pendleton Conklin
Laws	Omnibus Bill	Kansas-Nebraska Bill		Income Tax Law Civil Rights Bill	Salary Act	Anti-Chinese Bill	Civil Service Chinese Bill
Wars		Border warfare	J. Brown's Raid Mormon Insur'n	Civil War	Modoc Sioux	Nez Perce	Apaches captured
Inventions		Typesetting machine	Sleeping car Atlantic cable	Repeating rifle Gatling gun	Fire extinguisher Telephone Crematory	Steam heating Phonograph	Flying machine
Acquisitions		Gadsden		Alaska			
For'n Rel.	Clayton-Bulwer Treaty	Treaty with Japan	Treaty with China	Burlingame Treaty	Treaty of Washington	New Chinese Treaty	Treaty with China
Slavery	Fugitive Slave Law	Underground Railway	Dred Scott Decision	Secession of States 13th Amendment	Ku Klux Klan Colored Senator	Negro Exodus	
Deaths	Calhoun Webster Clay		Irving Mann	Tyler Jackson Van Buren Buchanan	Greeley Prentice Pierce Farragut	Bryant Young	Garfield Emerson Longfellow
States Admit.	California		Minnesota Kansas Oregon	West Virginia Nebraska Nevada	Colorado		
Miscellany		Lopez Expedition	Secession	Atlantic cable laid	Pacific R. R. Chicago Fire Weather Bureau	Electric light Lifesaving Station	Washington Monument
For'n Events	Cuban Revolution	Ostend Manifesto	Three-year war in Mexico	Fenian Raid in Canada Wars in South America	Franco-German War	Famine in Brazil	

ADMINISTRATIONS

	1885–1889	1889–1893	1893–1897	1897–1905	1905–1909	1909–1913	1913–1921
Pres.	CLEVELAND	HARRISON	CLEVELAND	MCKINLEY ROOSEVELT		TAFT	WILSON
Cab't	Bayard Fairchild	Blaine Elkins	Olney Carlisle	Root Day Wilson Hay	Taft Root	Knox MacVeagh	Bryan Lansing Lane McAdoo
Messages			Venezuela	Panama Canal	Trusts	Trusts	Tariff and Currency Peace Treaty
Chief Just.	Fuller					White	
Decisions			Income Tax	Northern Securities		Standard Oil Tobacco	Prohibition Volstead Act
Pres. Senate	Hendricks	Morton	Stevenson	Hobart Roosevelt	Fairbanks	Sherman	Marshall
Speak. House	Carlisle	Reed Crisp	Reed	Henderson	Cannon	Clark	Clark Gillette
No. Mems	Senate 76 House 332	Senate 88 House 357	Senate 88 House 357	Senate 90 House 386	Senate 90 House 386	Senate 92 House 391	Senate 96 House 435
Leaders	Logan Gorman	McKinley Sherman	Wilson Hill	Dingley Williams Hanna Hoar	Lodge Tillman	LaFollette Underwood	Martin Lodge Mann Underwood
Laws	Interstate Com. Act Dawes' Bill	International Copyright Law	Sherman Law Wilson Bill	Chinese Exclusion Bill	Pure Food Law Meat Insp. Bill	Payne-Aldrich Tariff	Tariff, Banking and Currency
Wars	Anarchist Riots	Sioux War	Coal strikes Railroad strikes	Spanish American Philippines	Springfield Riot		World War I U.S. entered 1917
Inventions		Natural gas used	Niagara Falls harnessed	Liquefied air Wireless telegraphy	Aeroplane		Wireless telephone
Acquisitions				Hawaii Porto Rico Guam Philippines Samoa			
For'n Rel.	Extrad. Treaty C-Bayard Treaty	Samoan Treaty Recip. Treaty		Arbitration Treaty Hay-Pauncefote Treaty	Hay-Varilla Treaty		Freedom of the Sea Mexican troubles
Slavery							
Deaths	Sheridan Arthur Seymour Grant	Fremont		Jos. Jefferson McKinley Harrison	Harper Hoar Cleveland	Harlan Dolliver	J. P. Morgan Theo. Roosevelt
States Admit.	Wash. Mont. N. and S. Dakota	Idaho Wyoming	Utah		Oklahoma	Arizona New Mexico	
Miscellany	Earthquake in Charleston	Johnstown Flood	World's Fair at Chicago	Baltimore Fire Hague Peace Conference	Panama Canal	Postal banks Parcel post	16th, 17th, 18th, 19th Amendments
For'n Events	Chinese Exclusion Act	Brazil Republic Boxer Rebellion	Cuban Rev. Hawaiian Rev.	Cuba under protection of U.S. Boer War	Russo-Japanese War	Turko-Italian War	Peace Treaty League of Nations

ADMINISTRATIONS

	1921	1923	1929	1933-1941	1941-1945	1945-1953	1953—
Pres.	HARDING	COOLIDGE	HOOVER	ROOSEVELT	ROOSEVELT	TRUMAN	EISENHOWER
Cab't	Hughes Hoover Wallace Mellon	Kellogg Mellon Hoover Davis	Stimson Mellon Hurley Adams	Hull Morgenthau Stimson Knox	Hull Morgenthau Stettinius Forrestal	Acheson Brannan Johnson Snyder	
Mes-sages	Budget Reform Postwar Problems	Economy, Tax Revision	Farm Relief, Tax and Tariff Revision	Recovery, Relief Banking	Atlantic Charter War Message	Inaugural Message	
Chief Just.	Taft	Taft	Hughes	Hughes	Stone	Vinson	Warren
Deci-sions	Income Tax		Railroad Revaluation	Wagner Labor Act Social Security Act	Fair Labor Standards Act	Religious Education in Public Schools	Antisegregation
Pres. Sen'te	Collidge	Dawes	Curtis	Garner Wallace	Wallace Truman	Barkley	Nixon
Speak House	Gillette	Gillette Longworth	Longworth Garner	Bankhead Rayburn	Rayburn	Rayburn	Martin Rayburn
No. Mems	Senate 96 House 435	Senate 96 House 435	Senate 96 House 435	Senate 96 House 435	Senate 96 House 435	Senate 96 House 435	Senate 96 House 435
Lead-ers	Lodge Underwood	Lodge Capper Underwood	Smoot Moses Robinson	Glass Barkley Vandenberg Wheeler	Barkley McNary Reed	Lucas McFarland Taft	
Laws	Budget Reform Tax Revision	Income Tax Immigration Law	Tariff Agricultural Relief	Banks, Selective Service, Labor, TVA	Lend-Lease Anti-Strike Price Control G.I. Bill	Presidential Succession Armed Forces Merger	St. Lawrence Seaway Antisubversive Laws
Wars				World War II	World War II	World War II Korean War	Korean Truce
Inven-tions	Radio Telephony	Television	Talking Pictures	Synthetic Products	Implements of War Wartime Substitutes	Atomic Bomb Home Television	Radioisotopes
Acqui-sitions							
For'n Rel.	Limit. Arms Conference	Kellog-Briand Treaty Marines in Nicaragua	Moratorium on German War Debt	Reciprocal Trade Pacts Pan American Conf.	War Conferences United Nations	United Nations Formed The Marshall Plan	Red China A World Power
Slav-ery					Release of Axis Slave Laborers	Axis Slave Laborers Repatriated	Soviet Slave Camps
Death	Champ Clark Cardinal Gibbons	Woodrow Wilson Cummins Lodge	Edison Coolidge Taft Longworth	Robinson Brandeis Card. Mundelein Borah	Knox Willkie Card. O'Connell	Stone Schwellenbach Hughes Murphy	Taft Fermi
States Admit.							
Miscel-lany	Teapot Dome Scandal	Lindbergh Flew to Paris	Economic Depression	Roosevelt Elected to Third Term	Roosevelt Elected to Fourth Term	States' Rights and Progressive Parties Formed	Communist Party Outlawed
For'n Events		Civil War—China Civil War—Mexico	Revolutions, S. Amer. Sino-Jap Conflict	Axis Nations Engulf Europe and Asia in War	Axis Nations Attack the United States	End of World War II Cold War	Guerrilla Warfare in East Asia

John Hancock Mutual Life Insurance Co.

GRACEFUL AS THE GULLS, Yankee clippers were the greyhounds of the seven seas. Their great speed helped American merchants to compete with the commercial powers of the Old World.

campaign of 1812, but Madison was re-elected. New England's Federalists remained hostile to the war effort, and in 1814, at the Hartford Convention, they made plans to amend the Constitution so as to increase their influence (see HARTFORD CONVENTION). The Treaty of Ghent, ending the war on December 24, 1814, wrecked their hopes of success (see GHENT, TREATY OF).

The Era of Good Feeling. From 1815 to 1824, national unity triumphed over political conflict in the United States. The democratic ideas Jefferson had supported swept over the nation; the movement to give all grown men the right to vote spread eastward from the frontier to the coast. The Federalist party, considered unpatriotic for its activity during the War of 1812, soon weakened and died, and the Jeffersonian-Republican party became the one American party. The last Federalist presidential candidate was easily defeated in 1816 by James Monroe, and in 1820 Monroe was re-elected.

A protective tariff was adopted to give American industry a chance to grow without too much competition from abroad (see TARIFF). The Second United States Bank was chartered (see BANK OF THE UNITED STATES). New York State's Erie Canal and the Federal Government's Cumberland Road were the most important of the numerous internal improvements which helped to connect the seaboard with the frontier (see CUMBERLAND ROAD; ERIE CANAL). Florida was purchased from Spain in 1819, and in 1823 President Monroe proclaimed the Monroe Doctrine, warning European powers to make no further attempts to extend colonization in the New World (see MONROE DOCTRINE). The Supreme Court under Chief Justice Marshall took a firm stand in favor of a strong national government as opposed to the individual rights of separate states.

The only threat to national unity in this period was disagreement over slavery. Northerners believed that slavery had no place in a democracy, while Southerners depended upon slave labor on their cotton plantations. Politics played an important part in the argument at a time when new states were entering the Union. The North wanted the new states to be free states, without slavery; the South wanted them to be slave states, so that they would increase Southern influence in Congress. The Missouri Compromise of 1820 was one of many attempts to satisfy both sides and to maintain a balance between free states and slave states (see MISSOURI COMPROMISE; SLAVERY).

Jacksonian Democracy. The election of 1824 was a contest among four Republican leaders—John Quincy Adams, Andrew Jackson, William Crawford, and Henry Clay. When no candidate received enough electoral votes to win, the House of Representatives decided the election by choosing Adams, to whom Clay gave his support. Adams then made Clay his Secretary of State, and Jackson accused the two of making a "corrupt bargain." Jackson and Vice-President John Calhoun joined forces against Adams and Clay, and the Jeffersonian-Republican party split into the National Republican group, led by Adams and Clay, and the Democratic-Republicans, led by Jackson and Calhoun. The National Republicans were later called the Whigs, and the Democratic-Republicans became the Democrats. Jackson defeated Adams for the Presidency in 1828 and won out over Clay in 1832 (see DEMOCRATIC PARTY; JACKSON, ANDREW).

As President, Jackson was the spokesman for the pioneer farmers of the frontier and the hero of the working people everywhere. The age of Jackson marked a great advance in American democracy. There was a spirit of equality in the air. The ordinary people insisted that government officials should be chosen by them from their own ranks. They also demanded free education for all.

But at this same time national unity gave way to conflict between the various sections of the country. The disagreement over slavery was turning the North and South into enemies. John Calhoun of South Carolina was the leader of the Southern group that believed the states had the right to ignore Federal laws in certain cases. The protective tariff which protected Northern industries from foreign competition meant high prices for Southern consumers, and South Carolina threatened to stop the collection of the tariff within its borders. Only a compromise worked out by Henry Clay prevented this issue from causing a crisis (see CALHOUN, JOHN; CLAY, HENRY).

Politics and Reforms. Martin Van Buren, Jackson's chosen successor, became President in 1837 (see VAN BUREN, MARTIN). Van Buren's great problem was the Panic of 1837 — an economic depression caused by too much speculation in western lands, by bad banking practices, and by unwise canal and railroad construction. The widespread unemployment, business failures, and huge state debts in this period led many voters to turn to the Whig candidate, William Henry Harrison, in the election of 1840. Harrison died soon after his inauguration, and his place was taken by the Vice-President, John Tyler of Virginia. Tyler, a former Democrat who still believed in states' rights and a strict interpretation of the Constitution, soon parted company with the Whig leaders and turned back to his old party (see TYLER, JOHN).

In these years there occurred a great flowering of American literature, especially in New England. It was a hopeful period, in which most Americans believed in progress and improvement for all. Movements for temperance and prohibition, prison reform, women's rights, and world peace all won wide support. The strongest of all these movements was the movement for the abolition of slavery. Antislavery societies sprang up throughout the North, and a new Liberty party took part in the election of 1840. The South, on the other hand, rallied to the defense of the slave system. See ABOLITIONISTS.

Manifest Destiny and the Mexican War. Between 1840 and 1850, America's national boundaries were rounded out from the Atlantic to the Pacific and from the Rio Grande to the 49th parallel. In the northeast the Webster-Ashburton Treaty with England settled the boundary between Maine and Canada (see WEBSTER-ASHBURTON TREATY). Elsewhere it was a time of territorial expansion; many believed that it was America's "manifest destiny," or natural fate, to spread out over the continent. Most attention was given to Texas, which had revolted against Mexico and was seeking admission to the Union as a slave state. There was also great interest in the Oregon territory, which was claimed by both the United States and Great Britain.

In the election of 1844 the Democratic candidate, James Polk, urged that Texas be annexed, while Henry Clay, the Whig, refused to take a stand on the issue. Because Clay had not come out against accepting Texas as a slave state, many antislavery voters backed the Liberty party, and with the opposition thus divided, Polk was elected. Congress voted for annexation early in 1845. The Mexican War broke out a year later when American troops were sent into territory claimed by both Texas and Mexico. Mexico's armies were defeated; and by the Treaty of Guadalupe Hidalgo in 1848 Mexico recognized America's annexation of Texas and ceded to the United States, for a payment of $15,000,000, a vast territory including all or part of the present states of California, New Mexico, Arizona, Utah, Nevada, Colorado, and Wyoming. Meanwhile Polk settled the Oregon question by accepting the 49th parallel as the boundary between the United States and Canada. See MEXICAN WAR; OREGON; POLK, JAMES; TEXAS.

A House Divided. In the election of 1848 the Whig candidate, General Zachary Taylor, was victorious chiefly because the new Free-Soil party drew enough antislavery votes to tip the balance against the Democrats (see TAYLOR, ZACHARY). The question of permitting slavery in the territory obtained from Mexico then increased the bitterness between North and South. When California asked admission to the Union as a free state in 1850, some settlement had to be reached. The Compromise of 1850 was another attempt to keep the nation from breaking apart (see COMPROMISE OF 1850).

In July, 1850, President Taylor died, and Vice-President Millard Fillmore became the Chief Executive. Two years later the Democrats returned to power with the election of Franklin Pierce as President (see PIERCE, FRANKLIN). In general the nation was prosperous. Manufacturing developed further in the North, cotton planting expanded in the South, and grain farming spread over the Midwest. The country was growing rapidly, but it was also growing apart. The industrial North depended on paid labor, while the agricultural South depended on slave labor. The North was moving far ahead of the South in wealth and population. Southern leaders looked upon the growth of the North as a threat to slavery and therefore a danger to their economic system and their way of life.

In 1854 Congress passed the Kansas-Nebraska Bill, which created the territories of Kansas and Nebraska and left it up to the settlers to decide whether or not they wanted slavery (see KANSAS-NEBRASKA BILL; SQUATTER SOVEREIGNTY). In Kansas a bloody struggle between the proslavery and antislavery settlers resulted, and throughout the country bad feeling over the slavery issue increased. The Whig party broke up, with most of the Southern Whigs joining the proslavery Democrats and many of the Northern Whigs forming the new Republican party with the Free-Soilers and other antislavery groups (see REPUBLICAN PARTY). In 1856 a Democrat, James Buchanan, was elected President, although the Republican candidate, John Frémont, carried most of the Northern states (see BUCHANAN, JAMES).

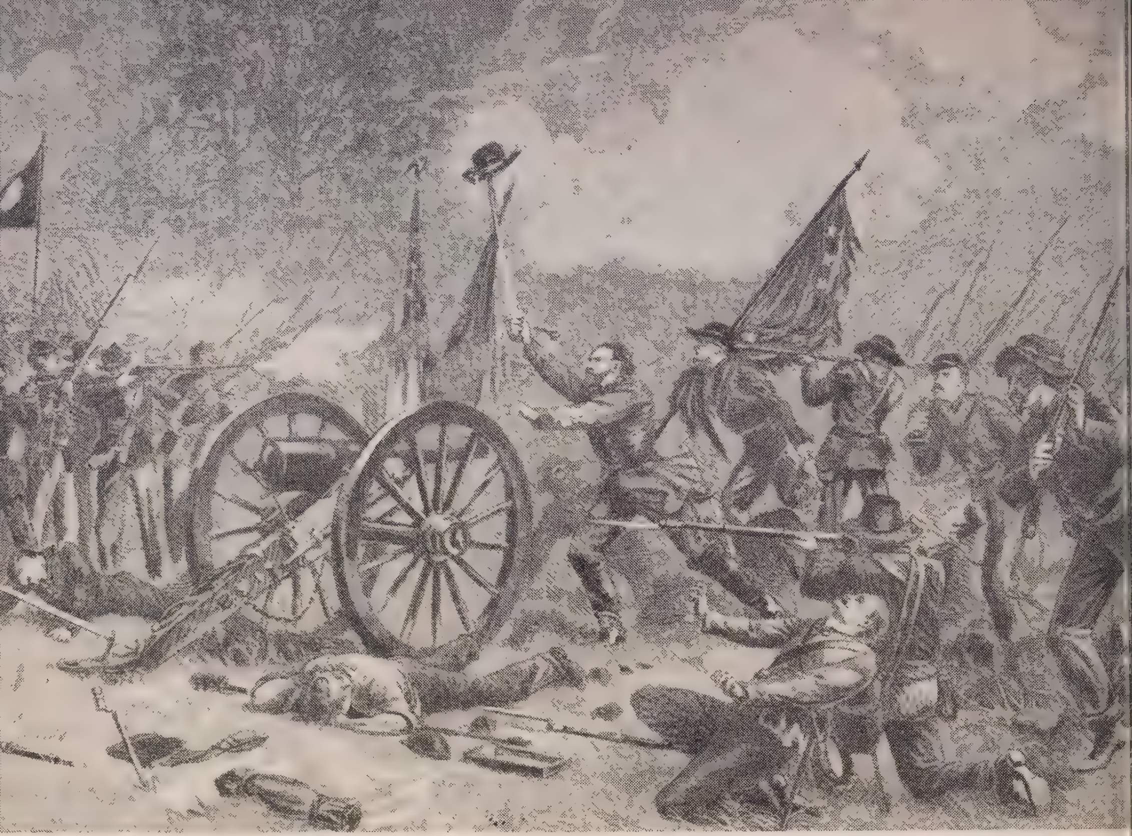
During Buchanan's administration, the Dred Scott case, the Lincoln-Douglas debates, and John Brown's raid on Harper's Ferry left little hope of settling the slavery issue peacefully (see BROWN, JOHN; DRED SCOTT DECISION; DOUGLAS, STEPHEN A.). In 1860 the Democratic party split over slavery; Northern Democrats put up one presidential candidate, while Southern Democrats put up another. When the Southern states threatened to secede from the Union if the Republican candidate, Abraham Lincoln, were elected, the new Constitutional Union party presented still another candidate, in an attempt at compromise (see CONSTITUTIONAL UNION PARTY). But Lincoln won the election, though by a very slim margin.

The War between the States. South Carolina, Mississippi, Florida, Alabama, Georgia, Louisiana, and Texas quickly seceded from the Union. The Confederate States of America was organized with Jefferson Davis as President. President Buchanan denied that the South had the right to leave the Union, but he took no action. The last attempts at compromise failed. In his Inaugural Address, President Lincoln declared that he would defend the Union by force rather than see it divided. On April 12, 1861, the war began with the Confederate attack on Fort Sumter. Virginia, Arkansas, Tennessee, and North Carolina then joined the Confederacy (see CONFEDERATE STATES OF AMERICA; SECESSION).

The South fought for independence; the North fought to force the South back into the Union. For two years the South, with its excellent generals, won most of the military engagements; after July, 1863, however, the greater wealth and greater industrial production of the North turned the tide of battle. The Union blockade of Southern ports and the invasion of the South by Union armies directed by General Grant finally made Confederate resistance hopeless. On April 9, 1865, General Lee surrendered his army to Grant at Appomattox.

In order to keep the four slave states — Kentucky, Missouri, Maryland, and Delaware — which had not left the Union, President Lincoln at first declared that the only purpose of the war was to save the Union. On January 1, 1863, however, he issued his Emancipation Proclamation, declaring all slaves in the rebellious states to be free (see EMANCIPATION PROCLAMATION). Although this act turned the war into a crusade for human freedom, the North grew weary of the conflict, and Northern Democrats called it a failure. Only Union victories in the fall of 1864 made it possible for Lincoln to win re-election (see LINCOLN, ABRAHAM).

Reconstruction. With the end of the war the Union was saved, and with the quick passage of the Thirteenth Amendment to the Constitution, slavery was ended forever. But the question of how the Confederate States were to be restored to the Union caused an angry conflict in the nation's



PICKETT'S CHARGE AT GETTYSBURG was one of many heroic actions in the War between the States, a conflict which shook the nation to its roots but preserved the Union.

capital. Lincoln, who had proposed a generous plan, was assassinated on April 14, 1865, and Vice-President Andrew Johnson took his place. Johnson tried to put through Lincoln's plan, but his policy was not accepted by the Republican leaders in Congress. Many Northerners wanted to punish the South for its rebellion and to force it to give voting privileges and all civil rights to the Negroes. Republican leaders feared that Johnson's policy would permit the Democrats to gain control of the Federal Government, and Eastern businessmen were afraid that they would lose their tariff protection when the South was restored to its old place.

Winning control of Congress in 1866, the Republicans pushed through their own reconstruction policy over the President's veto, putting the South under military rule and treating it as a conquered land. The Southern states were forced to ratify the Fourteenth Amendment, designed to guarantee civil rights to Negroes, and the Fifteenth Amendment, designed to protect the Negroes' right to vote. When Federal troops were finally removed from the South in 1877, however, Southern Democrats regained political control and restored the old system in which the white man was superior to the Negro. See RECONSTRUCTION.

Johnson was impeached by Congress in the battle over reconstruction and was very nearly convicted (see IMPEACHMENT; JOHNSON, ANDREW). In 1868 the Republicans elected General Grant, the Union war hero. His administration was marred by a series of scandals involving many of the President's friends, but he was re-elected in 1872 despite the fact that many Republicans voted for a reform candidate (see GRANT, ULYSSES S.).

Prosperity and Depression. After the war America enjoyed great prosperity. The protective tariff encouraged industries to expand. Many new inventions and mechanical improvements were introduced. The production of iron, steel, and oil developed great industries. In 1869 the first railroad across the continent was completed. Settlers poured out over the Great Plains, and other pioneers crossed the Rocky Mountains to the Pacific coast. Homestead laws encouraged settlement on the plains (see HOMESTEAD), and improved farm machinery made the new farms more productive. In the dry lands farther west, cattle raising became increasingly profitable. In many western areas fortunes in gold and silver were mined. By 1880, after a long and desperate struggle,

Denver Public Library Western Collection; Mural by Allen True

AMERICA RODE WEST IN A COVERED WAGON. The pioneers who led the way across the continent saw the greatest, richest expanse of untouched territory any nation has ever been fortunate enough to possess.

most of the plains Indians were subdued and forced to live on reservations. New crops and new industries were also bringing hope and progress to the South. The nation, united once more, celebrated its good fortune at the Centennial Exposition in Philadelphia in 1876.

On the other hand, economic progress was accompanied by many new problems. Dishonest political groups, like the Tweed Ring in New York, enriched themselves with public funds (see TWEED, WILLIAM MARCY). Big business concerns fought to make huge profits by both ethical and unethical means. Labor protested against low wages and long hours, and the outcry of Midwestern farmers against the treatment given them by the railroads led to the movement for the regulation of business by government. A financial panic in 1873 brought on an economic depression which resulted in even lower wages and widespread unemployment. Labor and management fought one another, and in 1877 Federal troops were used to check the disorder caused by a great railroad strike.

Politics and Political Discontent. From 1868 to 1900 the Republicans won all but two presidential elections. The Republicans worked for a high protective tariff, which aided the business of Eastern industrialists. The Democrats, who drew most of their support from the South, claimed to be against the tariff but did little to reduce it when they were in office. In the election of 1876 the Democratic candidate received a majority of the popular vote, but the Republican, Rutherford B. Hayes, became President when a special commission gave him twenty disputed electoral votes (see HAYES, RUTHERFORD B.). In 1880 James A. Garfield won for the Republicans; when he was assassinated a few months later, the Vice-President, Chester A. Arthur, took his place (see ARTHUR, CHESTER A.).

In 1884 the Democrats finally scored a victory when Grover Cleveland won the election. After extending civil service reform, vetoing numerous pension bills, and working for tariff reduction, he was defeated for re-election on the tariff issue, though he won a majority of the popular votes cast (see CLEVELAND, GROVER). A Republican, Benjamin Harrison, became the new President (see HARRISON, BENJAMIN).

The growth of labor unions, as well as the reform of civil service, was notable in this period. The passage of the Pendleton

Civil Service Act in 1883 checked the old practice of replacing all government employees of one party with those of the other whenever there was a change in political control (see CIVIL SERVICE). The labor movement was a result of the nation's industrial growth; the small shops of early times gave way to large companies employing hundreds and thousands of workers. The first powerful labor union, the Knights of Labor, reached its peak in 1886. Later the American Federation of Labor became the leader of organized labor. During the prosperous 1880's, labor fought without success for an eight-hour workday. Strikes were frequent and often violent, as in the Haymarket Riot in Chicago.

Throughout this period farm prices were falling, and the farmers were losing their lands and their homes. Dissatisfied with the two major political parties, farmers organized the Grange, the Farmers' Alliance, and the Greenback party to work for their interests. In the Congressional elections of 1878 the Greenbackers, who wanted the government to put more paper money into circulation, polled more than a million votes. After that, those who believed that the country needed inflation — more money in circulation and higher prices — demanded the free and unlimited coinage of silver with its value fixed at a high level in relation to gold.

The Populist Movement. The Democratic party returned to power in 1892 when Cleveland won a second term. A strong third party, the Populists, appeared in this election. The Populists wanted free coinage of silver, an income tax, public ownership of railroads, an eight-hour day for labor, the Australian ballot (see BALLOT), and many other reforms. The Populist movement was still another result of the hard times in farming areas, and it gained new followers in the economic depression which began in 1893. Resisting the demand for "cheap" money, President Cleveland worked to preserve the gold standard so that American currency would be solidly based on gold. At the Democratic convention in 1896, however, the party nominated William Jennings Bryan on a platform demanding the free coinage of silver. The Populists supported Bryan. The Republicans made William McKinley their candidate and took a strong stand for the gold standard, as opposed to the "cheap-money" silver policy. McKinley was elected, and with the return of prosperity the Populists and the silver issue lost support, though many of the Populists' other policies were adopted. See BIMETALLISM; BRYAN, WILLIAM J.; MCKINLEY, WILLIAM.

A World Power. With the nation settled and the frontier gone, America began to look beyond its borders. The United States joined with neighbor republics to form the Pan American Union (see PAN AMERICAN UNION). In 1898 America annexed the Hawaiian Islands. In the same year occurred the Spanish-American War, brought on by American sympathy for the native rebellion against Spanish rule in Cuba. The American victory proved that the United States had become a great naval power. Puerto Rico, the Philippine Islands, and Guam were made American possessions. See SPANISH-AMERICAN WAR.

In 1900 the Democrats again nominated Bryan, who opposed the "imperialist" policy that led the United States to reach out beyond its borders for foreign territories. The Republicans again nominated McKinley, who was easily re-elected. The next year he was killed by an assassin, and the Vice-President, Theodore Roosevelt, became Chief Executive. Under the active foreign policy directed by the new President, America acquired the Panama Canal Zone and began building the canal, displayed its power to the small republics of the Caribbean area, arranged a settlement of the Russo-Japanese War, and took part in diplomatic dealings involving the European powers. The United States had become one of the great nations. See PANAMA; PANAMA CANAL; RUSSO-JAPANESE WAR; ROOSEVELT, THEODORE.

Roosevelt and the Progressives. Roosevelt, a very popular leader, set himself up as the defender of the underprivileged. He forced the owners to arbitrate in a strike of the anthracite coal miners and launched legal action against some of the larger trusts — business combinations controlling certain enterprises. The railroads were put under stricter regulation, and laws were passed to protect the people from impure foods (see PURE FOOD LAWS). The President played a leading role in the movement for the conservation of America's natural resources (see CONSERVATION). Roosevelt won the presidential election of 1904 and persuaded his party to nominate William Howard Taft in 1908. Taft was an easy victor over Bryan, again the Democratic candidate.

A general reform movement swept the country in the early 1900's. Newspaper and magazine writers "exposed" the corruption and dishonesty in business and politics and drew the public's attention to the crime and poverty in America's big cities. The commission and city-manager forms of local government were devised for more efficient administration. The direct primary came into use, and many states adopted the initiative and referendum (see INITIATIVE; PRIMARY ELECTION; REFERENDUM). Constitutional amendments providing for the income tax and for the direct election of Senators were adopted in 1913. Prohibition and woman suffrage were winning strong support (see PROHIBITION; WOMAN SUFFRAGE).

President Taft was unable to win the popularity "Teddy" Roosevelt had enjoyed (see TAFT, WILLIAM H.). The tariff act of 1909 was sharply criticized, and many Republicans lost in the Congressional elections of 1910. As the progressive movement grew stronger, Roosevelt came back into politics to oppose Taft. When the Republicans renominated Taft in 1912, Roosevelt organized his own Progressive party. The Democrats nominated Woodrow Wilson, who triumphed over the divided opposition.

The Wilson Administration. Wilson brought the progressive spirit into the White House. He announced that his program was designed to break down big business trusts, or monopolies, and under his leadership Congress lowered the protective tariff, which the progressives called the "mother of trusts." The Clayton Antitrust Act, supplementing the Sherman Act of 1890, was passed to preserve free competition (see TRUSTS), and the Federal Trade Commission was created to prevent unfair methods of competition (see FEDERAL TRADE COMMISSION). Easy credit was made available to farmers; agricultural education was given government aid and encouragement; Federal funds were granted to the states for road building; and the Federal Reserve Act set up a new national banking system (see BANKS AND BANKING). In foreign affairs Wilson's great aim was to promote world peace. Arbitration treaties were arranged with some thirty nations. In Mexico a long series of revolutions endangered American lives and property, but while a number of "incidents" almost caused war between the two countries, all-out hostilities were avoided.

World War I. When World War I began in Europe, Wilson declared America to be neutral. As the conflict continued, both sides caused repeated damage to American interests despite the President's protests. Britain's blockade prevented America from trading with Germany, and German submarines set out to check the flow of American goods to the Allied powers. In 1916 Wilson managed to win out over his Republican opponent chiefly because he had kept the country out of war. War orders from abroad had also brought the nation great prosperity.

The crisis came in January, 1917, when the German Government announced that it would resume unrestricted submarine warfare — a policy it had given up earlier because of American protests. Wilson broke off diplomatic relations with Germany, and on April 6 Congress declared war. American farms and factories were mobilized for war production, and food and supplies were rapidly shipped across the Atlantic. The Allies received about ten billion dollars in loans. Wilson became the world's spokesman for democracy, and his Fourteen Points were proclaimed as the basis for a just and lasting peace to follow this "war to end wars" which would "make the world safe for democracy." American manpower was conscripted for the armed forces, and 1,400,000 Americans saw service overseas. Germany was near victory in July, 1918, but then its advance was turned into retreat as great numbers of American troops poured into the fighting lines. On November 11, 1918, Germany was forced to sign an armistice.

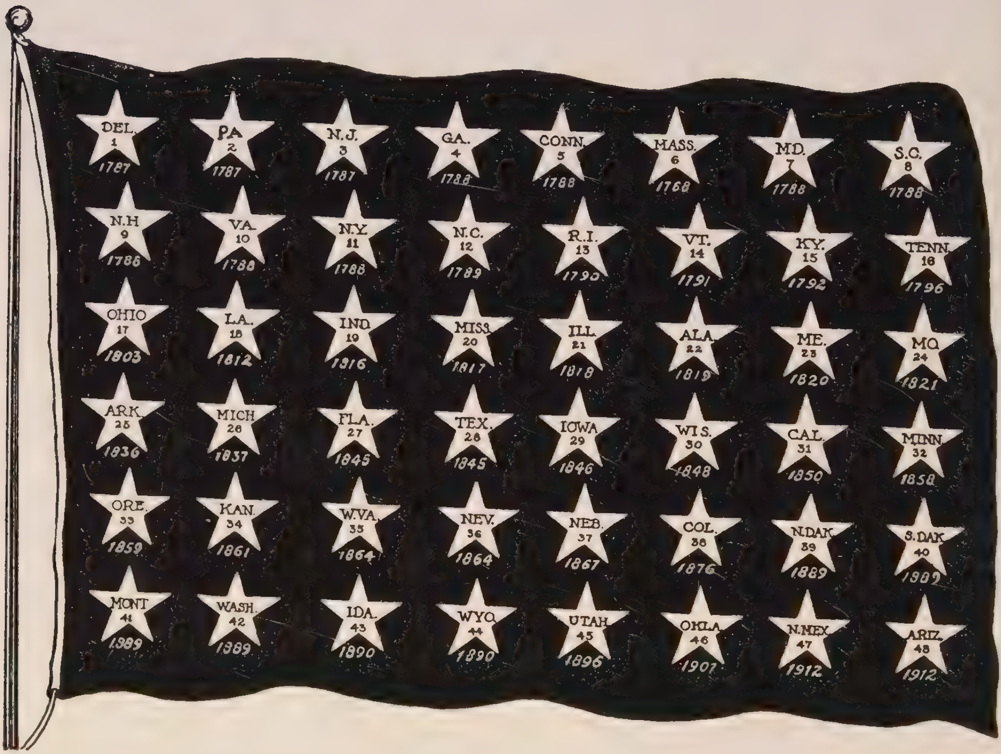
At the Paris Peace Conference, Wilson worked for a peace that would be just for all, but other Allied leaders insisted on punishing the defeated foe. The Treaty of Versailles included the Covenant of the League of Nations, a project which Wilson hoped would bring permanent peace but which many Americans, wanting nothing more to do with foreign affairs, strongly opposed. The Republicans had won control of Congress in 1918, and the Senate refused to accept the Treaty of Versailles. See VERSAILLES, TREATY OF; WILSON, WOODROW; WORLD WAR I.

Prosperity and Depression. The election of 1920 resulted in a landslide for Warren G. Harding, the Republican candidate, who promised the country "a return to normalcy." Most of Wilson's policies were rejected by the new administration. The tariff was raised, and big business was assisted in other ways. It was a time of industrial prosperity and progress. New inventions brought comforts and luxuries to more and more of the people. The most troublesome problem was national prohibition, established by the Eighteenth Amendment. The saloon was outlawed, but its place was taken by the illegal "speakeasy" and the criminal bootlegger.

Graft and corruption by public officials marred the administration of Harding, who died in August, 1923, before the scandals were uncovered (see HARDING, WARREN G.). He was succeeded by the Vice-President, Calvin Coolidge, who was easily elected to the Presidency the next year. Senator Robert La Follette of Wisconsin, the candidate of a new Progressive party, received nearly five million votes from farmers, who were suffering hard times, and from other discontended members of both parties. Coolidge vetoed several farm-relief bills passed by Congress. Meanwhile, industrial production boomed, and great numbers of citizens gambled on the continuing rise of the stock market (see COOLIDGE, CALVIN).

In 1928, with general prosperity on all sides, the voters once again elected a Republican President—this time Herbert Hoover. Soon afterward the stock market collapsed, and prosperity turned into depression. Factories closed, banks failed, and millions lost their jobs, but the administration continued to oppose direct government aid to the needy (see HOOVER, HERBERT).

The New Deal. Hard times destroyed Republican power. In 1932 the Democrats triumphed with Franklin D. Roosevelt, who promised a "new deal for the forgotten man." Billions of dollars were appropriated to help the needy, and work was provided for the unemployed. Aid was given to farmers, and laws favorable to organized labor were passed. The Social Security Act provided old-age pensions and other benefits. In 1936 Roosevelt carried forty-six states. Already he was being criticized for spending too much money and seeking too much power, but his popularity with the people was tremendous.



THE DEVELOPMENT OF THE FLAG parallels the building of the nation.

The United States and the World. After rejecting the League of Nations in 1920, America took little interest in the outside world, though it joined in international pacts aimed at preserving world peace. Much trouble arose out of the huge loans America had made to other nations in World War I, and during the Great Depression, when practically all repayments ceased, bad feeling between Europe and America increased.

Meanwhile, Germany under Hitler and Italy under Mussolini built up armies and prepared for conquest. In the Far East, Japan sent its forces against China. In time these warlike countries, the so-called Axis powers, formed an alliance that threatened the world. The League of Nations protested their acts but had no power to stop them. President Roosevelt wanted to "quarantine" the warmakers; but Congress, working for complete neutrality, took steps to keep American ships and American citizens out of war zones and to forbid loans to all countries engaged in conflict.

World War II. War in Europe broke out in 1939, and German victories in 1940 caused the United States to start a hurried defense program. During this emergency Roosevelt was re-elected once more, breaking the national tradition against a third term for a President. While preparing for defense the United States Government granted many forms of aid to the hard-pressed British.

Finally, on December 7, 1941, America was plunged into the conflict by the Japanese attack on Pearl Harbor.

American forces and American production played an important part in the defeat of the Axis. Industrial expansion was tremendous, and millions of citizens, including great numbers of women, entered war work. Supplies from America bolstered the war effort in Allied nations, and American servicemen saw action in Europe, Asia, Africa, and the islands of the Pacific. After its period of withdrawal from international affairs, the United States took on new responsibilities as a leader in the organization of the United Nations. Germany surrendered in May, 1945. Three months later, after America had made the first use of the atomic bomb, Japan also gave up, and the terrible conflict was ended. Roosevelt was elected for a fourth term in 1944. Upon his death in April, 1945, his Vice-President, Harry S. Truman, became Chief Executive. See Nations, United; Roosevelt, Franklin D.; World War II.

Postwar Politics. During Truman's administration there was controversy between Democrats and Republicans, between President and Congress, and between factions of the Democratic party. The President proposed numerous "Fair Deal" reforms, but Congress took little action. In 1948, when most experts were convinced that the Republicans would win the election, Truman scored a surprise victory. He was opposed not only by the other major party but also by two minor parties — the left-wing Progressives and a Southern states'-rights group that broke away from the Democratic organization and became known as "Dixiecrats." In 1951, the Twenty-second Amendment, limiting future Presidents to two terms, was adopted. See Truman, Harry S.

The Cold War. Soon after the end of World War II, the newly formed United Nations became the scene of constant conflict between the United States and its wartime ally, Soviet Russia. Soviet control of the small countries near its European borders raised an "iron curtain" across Central Europe, dividing the democracies of the West from the Communist states of the East. In order to meet the Communist threat to the democracies, the United States granted these countries billions of dollars' worth of aid under the Marshall Plan and the European Recovery Program and joined in a military alliance of anti-Communist powers under the North Atlantic Treaty.

In 1950 the United States took the lead in the struggle of the United Nations against Communist aggression in far-off Korea, and soon the defenders of the Republic of Korea were involved in an undeclared war with Communist China, the huge ally of the U.S.S.R. See Korea.

In 1952, while the war was still in progress, General Dwight D. Eisenhower was elected President of the United States by an overwhelming popular and electoral majority. See Eisenhower, Dwight D.

For a more detailed treatment of United States history since the adoption of the Constitution, consult the articles on the Presidents and the *History* sections in the articles on the states.

Related Articles. The following lists comprise a representative selection from the many hundreds of articles in this set relating to the United States.

OUTLYING TERRITORY

Alaska
Guam
Hawaii
Pacific Islands (trust territory)
Panama Canal (Zone)
Puerto Rico
Samoa
Virgin Islands of the United States

STATES AND CITIES

Each of the 48 states is treated under its own name, and there are separate articles on the important cities in each state.

GEOGRAPHY

Adirondack Mountains
Aleutian Islands
Allegheny Mountains
Appalachian Mountains
Arkansas River
Blue Ridge
Cascade Range
Catskill Mountains
Champlain, Lake
Chesapeake Bay
Coastal Plain
Colorado River
Columbia River
Cumberland Mountains
George, Lake
Grand Canyon of the Colorado
Great Lakes
Great Salt Lake
Gulf Stream
Hudson River
McKinley, Mount
Mexico, Gulf of
Mississippi River
Missouri River
Moosehead Lake
Niagara Falls and River
Ohio River
Ozark Mountains
Piedmont Region
Platte River
Puget Sound
River
Rocky Mountains
Sacramento River
Saint Lawrence River
Saint Marys River
San Joaquin River
Shasta, Mount
Sierra Nevada
Whitney, Mount

MINERALS

Aluminum
Asbestos
Bauxite
Clay
Coal
Copper
Gas, Natural
Gold
Granite
Gypsum
Helium
Iodine
Iron
Lead
Limestone
Marble
Mercury
Molybdenum
Petroleum
Salt
Sand
Sandstone
Silver
Steel
Sulfur
Tungsten
Uranium
Vanadium
Water
Zinc

AGRICULTURE — TYPES AND PRACTICES

Agriculture
Conservation
Crop Control
Dairy Farming
Diseases of Animals
Diseases of Plants

Drainage
Dry Farming
Fertilizers
Forests and Forestry
Gardening
Genetics
Grafting
Insecticides and Fungicides
Horticulture
Hybrid
Irrigation
Rotation of Crops
Seeds
Silo and Silage
Soil

AGRICULTURAL PRODUCTS

Alfalfa
Cotton
Domesticated Animals (with list)
Fruit (with list)
Grains (with list)
Grasses (with list)
Hay
Herbs (with list)
Nut (with list)
Sugar Cane
Tobacco
Soybean
Vegetables (with list)

BUSINESS AND INDUSTRY

Advertising
Better Business Bureau
Board of Trade
Chain Stores
Consumer Education
Department Store
Dress
Federal Trade Commission
Garment Industry
Industrial Design
Industry (with list)
Installment Buying
Insurance
Invention
Mail-Order Business
Marketing
Mass Production
Packaging
Personnel Management
Salesmanship
Stock Exchange

TRANSPORTATION AND COMMUNICATION

Federal Communications Commission
Interstate Commerce Commission
Magazine
Newspaper
Parcel Post
Post Office Department
Radio
Telegraph
Telephone
Television
Transportation (with list)

GOVERNMENT AND POLITICS

Alderman
Alien
Ballot
Birth Registration
Budget
Cabinet
Capitals of the United States
Census
Citizen
City
City Manager
City Planning
Civil Service
Commission Form of Government
Congress of the United States
Conscription
Constitution of the United States
Copyright
County
Court
District of Columbia
Election
Electoral College
Flag
Government
Impeachment
Initiative
Naturalization
Parks, National
Passport
Patent
Political Party
Primary Election
Recall
Referendum
Representatives, House of
Secret Service, United States
Securities and Exchange Commission
Senate of the United States
State
Suffrage
Township
Woman Suffrage

DEFENSE

Air Force
Army
Coast Guard
Defense, Department of
Marine Corps
Merchant Marine
Navy
Seabees

BIOGRAPHIES

In these volumes are articles on all of the Presidents and on important statesmen, political leaders, soldiers, writers, scientists, and many others who have contributed to the nation's development. See also lists following the article BIOGRAPHY.

HISTORY

Abolitionists
Albany Congress
Alien and Sedition Laws
Clayton-Bulwer Treaty
Compromise of 1850
Confederate States of America
Confederation, Articles of
Declaration of Independence
Dred Scott Decision
Emancipation Proclamation
French and Indian Wars
Fugitive Slave Laws
Gadsden Purchase
Ghent, Treaty of
Guadalupe Hidalgo, Treaty of
Indians, American
Indian Territory
Intolerable Acts
Jamestown
Jay's Treaty
Kansas-Nebraska Bill
Kentucky and Virginia Resolutions
Liberty Bell
Louisiana Purchase
Mason and Dixon Line
Mexican War
Missouri Compromise
Monroe Doctrine
Navigation Acts
Negro
New England Confederation
Northwest Territory
Nullification
Ordinance of 1787
Paris, Treaties of
Plymouth Colony
Reconstruction
Revolutionary War in America
Secession
Sedition
Slavery
Spanish-American War
Squatter Sovereignty
Stamp Act
Treason
Versailles, Treaty of
War of 1812
Washington, Treaty of
Webster-Ashburton Treaty
World War (I, II)
XYZ Correspondence

INTERNATIONAL RELATIONS

Alabama, The
Arbitration
Balance of Power
Bering Sea (Bering Controversy)
Diplomacy
International Bank
International Relations
International Trade
Nations, United
Neutrality
Pan American Conferences
Pan American Union
Treaty
Trusteeship
War

Books for Reading and Reference

Social Life and Customs

BAILEY, CAROLYN SHERWIN. *Children of the Handcrafts. Homespun Playdays. Tops and Whistles.* Viking. Stories of early American children, telling how they worked and played.

BECKER, MAY LAMBERTON, ed. *Growing Up with America, an Anthology.* Lippincott. Covers colonial child life; youth westward in the seventies and eighties; being young in the nineties; the youth of the twentieth century.

LANGDON, WILLIAM CHAUNCY. *Everyday Things in American Life, 1607-1776* (and a supplement covering 1776-1876). Scribner.

ODUM, HOWARD W. *American Social Problems.*

Holt. A textbook presenting a comprehensive picture of the American scene.

WOODWARD, WILLIAM E. *The Way Our People Lived.* Dutton. Describes in eleven fictional episodes the lives of Americans in various sections of the country in periods ranging from 1652 to 1908.

Politics and Government

ELTING, MARY, and GOSSETT, MARGARET. *We Are the Government.* Doubleday. Describes the organization and functions of the government. Suitable for grades six to nine.

FAULKNER, HAROLD UNDERWOOD. *American Political and Social History.* Appleton.

KEOHANE, ROBERT EMMET, and others. *Government in Action.* Harcourt.

McFEE, INEZ NELLIE CANFIELD. *How Our Government Is Run.* Crowell. A book for young citizens.

History

ADAMS, JAMES TRUSLOW, and others. *Album of American History.* Scribner. A picture history of the United States from the time of Columbus.

BEARD, CHARLES AUSTIN and MARY RITTER. *Rise of American Civilization.* Macmillan.

DALGLIESH, ALICE. *America Builds Homes.* Scribner. A story of the first colonies, for young readers.

DAVID, MARSHALL B. *Life in America* (2 vols.). Houghton (published in association with the Metropolitan Museum of Art). A history of America illustrated by pictorial material contemporary with the events depicted.

LAWSON, ROBERT. *Watchwords of Liberty; a Pageant of American Quotations.* Little. The words of great Americans in war and peace, highlighting memorable events from the days of the Pilgrims. Appropriate illustrations and story material accompany the quotations.

NEVINS, ALLAN, and COMMAGER, HENRY STEELE. *Short History of the United States.* Modern Library. American history presented as the story of the evolution of a free society.

WOODBURN, JAMES ALBERT, and others. *Our United States; a History of the Nation.* Longmans. A standard textbook.

General

ALBRIGHT, HORACE MARDEN, and TAYLOR, FRANK JOHN. *Oh, Ranger!* Dodd. A book about the national parks.

FOLLETT, HELEN THOMAS. *Ocean Outposts.* Scribner. Describes the island possessions of the United States.

PEATTIE, DONALD CULROSS. *Journey into America.* Houghton. The nature of the American past seen through a study of old American towns.

PERRY, GEORGE SESSIONS. *Cities of America.* McGraw.

PYNE, MABEL MANDEVILLE. *Little Geography of the United States.* Houghton. A pictorial geography for young readers.

Outline on the United States

I. A Federal Republic

II. Area
- A. Continental United States
- B. Outlying dependencies

III. Location
- A. Between two oceans
- B. Between two nations

IV. Main Physical Regions
- A. Atlantic and Gulf Coastal Plain
- B. Appalachian Highlands
- C. Interior Plains
- D. Rocky Mountains and Intermountain Plateaus
- E. Pacific Highlands and Lowlands

V. Climate
- A. Variations
- B. Climatic regions

VI. Plant and Animal Life
- A. In the forests
- B. In the grasslands
- C. In desert regions
- D. Fur bearers and fish

VII. Minerals and Mining
- A. Resources and reserves
- B. Extent of mining

VIII. Agriculture
- A. The American farmland
  - 1. Number of farms
  - 2. Value of lands and buildings
- B. Production areas
  - 1. Hay and Dairy Region
  - 2. Forest and Hay Region
  - 3. Middle Atlantic Truck Crop Belt
  - 4. Humid Subtropical Crop Belt
  - 5. Cotton Belt
  - 6. Corn and Winter-Wheat Belt
  - 7. Hard Winter-Wheat Belt
  - 8. Spring-Wheat Belt
  - 9. Corn Belt
  - 10. Grazing and Irrigated Crops Region
  - 11. Northwest Forest and Hay Region
  - 12. Columbia Plateau
  - 13. Northern Pacific Forest, Hay, and Pasture Region
  - 14. Pacific Subtropical Crops Region
- C. Agricultural methods
- D. Agricultural products

IX. Manufacturing
- A. Favorable conditions
  - 1. Abundance of raw materials
  - 2. Reserves of manpower
  - 3. Transportation and markets
  - 4. Free trade between states
  - 5. Efficient labor force
  - 6. Capital for investment, experiment, and research
  - 7. Initiative and technical skill
- B. Manufacturing districts
- C. Principal manufactures

X. Transportation
- A. By water
  - 1. Merchant marine
  - 2. Inland waterways
- B. By land
  - 1. Railroads
  - 2. Street railways
  - 3. Highways
    - a. Automobiles
    - b. Trucks
    - c. Buses
- C. By air
- D. Pipelines

XI. Communications
- A. Mail service
- B. Telephone

C. Telegraph
D. Radio
E. Television
F. Books and periodicals

XII. The American People
A. Races and nationalities
B. Rural and urban dwellers
C. How Americans live
D. Religion in America
E. The American character
F. Education
G. Progress in culture

XIII. Government
A. Early steps toward self-government
B. America under Articles of Confederation
C. The federal system
   1. Division of powers between central government and states
   2. A republican form of government
   3. Government by the people
   4. Written Constitution
   5. Bill of Rights
   6. Division of powers among three branches
      a. Legislative
      b. Executive
      c. Judicial
   7. System of checks and balances
   8. Strong Chief Executive
   9. Cabinet of executive heads
D. State government
E. Local government
F. Territorial government
G. Outlying possessions

XIV. History
A. Discovery and exploration
B. Colonial period
C. War for Independence
D. From Confederation to Constitution
E. Organization of constitutional government
F. Development of parties
G. Territorial expansion
H. America becomes a world power

Questions

1. Geographically, why is the United States one of the most favored regions of the world?

2. Describe the American Republic as to area and location.

3. What are its chief physical divisions?

4. Show how various surface features of the United States have played an important part in the development of social and economic systems.

5. Locate and account for the various types of climate found in continental United States.

6. What interesting forms of bird life are found throughout the continent?

7. Contrast the Coniferous Forest with the Deciduous Forest as to bird, plant, and animal life.

8. What can be said of the forest regions throughout the United States?

9. List interesting facts about the grasslands.

10. Can there be any life on American deserts? Give reasons for your answer.

11. Describe the fur trade of the United States.

12. What different types of fisheries are there in the United States?

13. How important are the mineral resources and the mining industry?

14. Interpret the graph which shows the agricultural production of the United States.

15. List interesting factual differences concerning United States agriculture.

16. Describe manufacturing in the United States, giving a clear picture as to natural conditions and human influence that have encouraged this industry.

17. Name and describe the various types of transportation in the United States.

18. What can be said of the communication systems used in the United States? Give a detailed description.

19. Interpret data concerning the census of the United States.

20. Trace the development of America's government.

21. What are the distinctive features of the federal system under which the American people are governed?

22. How does the United States Constitution safeguard the liberties of the people?

23. What powers do the states possess, and what powers are they denied?

24. What is meant by the "system of checks and balances"?

25. What reasons had the English colonists for rebelling against the mother country?

26. List the occupational opportunities offered early settlers in various sections of the new country.

27. What were the weaknesses of the Articles of Confederation?

28. What were the results of the French and Indian War?

29. List the causes and effects of the War for Independence.

30. Discuss the First and Second Continental Congresses as to purpose, attitudes, and reactions toward the mother country.

31. What were the provisions of the Ordinance of 1787?

32. Write a report on the Constitutional Convention. Why were these years called the "critical period"?

33. Outline the administration of George Washington.

34. What were the Alien and Sedition Laws?

35. What is meant by Jeffersonian Democracy?

36. Of what importance was the War of 1812?

37. How did the first political parties come into existence?

38. Outline important events occurring during the Era of Good Feeling.

39. What is the basic idea of the Monroe Doctrine?

40. Outline the administration of Andrew Jackson.

41. Mention the effects of the Mexican War.

42. What were the main issues between the North and the South in the War between the States? Discuss fully.

43. Give an account of the policy of reconstruction.

44. What is the origin of the Civil Service?

45. Give the history of the Pan American Union and the Panama Canal.

46. Outline Theodore Roosevelt's administration.

47. What was the policy of Woodrow Wilson and mention two points you consider important.

48. What was the attitude of the United States toward the belligerents before the nation entered each of the two World Wars?

49. What great postwar issue made the United States the opponent of its wartime ally, Soviet Russia?

UNITED STATES STEEL CORPORATION, one of the largest industrial organizations in the United States, is a group of more than thirty individual companies, each of them concerned with some part of steel production. Together they handle every operation from the mining of ore and coal to the making of finished steel products and their use in the construction of steel bridges and skyscrapers. Ore and coal mines, limestone quarries, steamship and railroad lines, cement works, coke ovens, steel-processing mills, warehouses, and manufacturing plants where all kinds of steel products are made are among the industries that belong to the United States Steel family.

The corporation has 300,000 employees in plants scattered across the nation, and the stockholders number about 228,000. When the corporation was formed in 1901, it turned out about two thirds of the total output of steel in the United States. Thirty years later, total production was much higher, but because other companies had come into the field the proportion contributed by United States Steel had dropped to one third.

UNITED STATES SUPREME COURT. See SUPREME COURT OF THE UNITED STATES.

UNITY, a religious movement officially called the Unity School of Christianity, was founded about 1890 by Charles and Myrtle Fillmore and now has its headquarters at Kansas City, Mo. It is both a school, operating largely by mail, and a separate sect, with its own churches ("centers"), clergy, and statement of faith. According to Unity, man is reborn after death and has a new life. Ill-health is the result of sin. A person who believes faithfully in the "Christ life" is regenerated in body so that he will never die. The goal is eternal life in the body.

U'NIVALVE. See MOLLUSCA.

UNIVER'SALISTS, those who believe that all men will finally achieve salvation. Today the name usually refers to the members of the Universalist Church of America. Universalism has been taught ever since the early period of Christianity, but the first separate Universalist church was organized in 1779 in Gloucester, Mass., by John Murray, a former English Methodist preacher. During the first half of the nineteenth century, Hosea Ballou was the leader of the growing movement. The Universalist General Convention of the United States was organized in 1870. The essential principles are: the universal Fatherhood of God; the spiritual authority and leadership of His Son, Jesus Christ; the trustworthiness of the Bible as containing a revelation from God; the certainty of just retribution for sin; and the final harmony of all souls with God. The churches are organized by local parishes or congregations. The membership in the United States is about 45,000.

UNIVERSE, the orderly system that includes all of the creation known to man: the earth, the sun, and the rest of the solar system, the stars, and the immensely distant galaxies. From the smallest particles of matter to the enormous star systems, the different parts of the universe are composed of the same basic elements and obey the same physical laws.

The dimensions of the known universe are so great that they must be expressed in large units. Light travels at about 186,000 miles a second, and one of the common units used by astronomers is the distance that light travels in a year. The light-year is about six million million miles. Distances within the solar system are relatively small. Light from the moon reaches the earth in less than 1½ seconds. The sun's light crosses the 93,000,000 miles to the earth in 8⅓ minutes. The nearest star is more than four light-years away.

The sun and its family are in a great formation of stars, the Milky Way system, or the Galaxy. This flattened swarm of stars, probably spiral in shape, may contain a hundred billion stars. It may be from 80,000 to 100,000 light-years in width, and 10,000 light-years in thickness. Though these distances are so great that they are hard to imagine, they are small in comparison to those outside our own star system.

Beyond the limits of the Galaxy, at distances on the order of a million light-years, are other galaxies, probably similar in character. The 200-inch Hale reflector of the Palomar Observatory can photograph objects a billion light-years from the earth. There are perhaps a hundred million galaxies within 500,000,000 light-years of the earth.

Man's search for knowledge has continually pushed back the boundaries of the universe. With the aid of the great telescopes, the astronomer has reached out into the depths of remote space, while the physicist has investigated the structure of the atom, working with distances almost inconceivably small. Both find that the stuff of which the universe is made is the same everywhere and subject to the same laws, whether it is studied in the most minute particles or in the most distant stars. See also ASTRONOMY; GALAXY; SOLAR SYSTEM; STARS; SUN.

UNIVERSITY EXTENSION, a program of adult education offered by a university to meet the needs of the community. The university extends its services to the community by giving courses for adults who are not registered as regular students on the campus. Because many of these people are employed, classes are usually scheduled in the evening or the late afternoon, or on Saturdays. Some are given on the campus, but others may be held at some distance from the university. The extension courses cover many subjects and include lectures, discussion groups, and professional and vocational training. Lectures are sometimes given by radio. Some extension work may be taken by correspondence. Credit toward a degree is sometimes granted to students who successfully complete an extension course, but the main purpose of an extension program is to provide opportunities for people who want to continue their education, whether they plan to study for a degree or not. See also ADULT EDUCATION.

UNKNOWN SOLDIER TOMBS. In France was born the idea of perpetuating the memory of the countless thousands who died in World War I and lie buried in unidentified heroes' graves. On November 11, 1920, a French soldier, selected because it was impossible to learn his identity, was buried with full military honors under the Arch of Triumph in Paris. An undying flame burns at the tomb as an everlasting reminder of the sacrifice made by all who lost their lives in the war. That same day Great Britain interred at Westminster Abbey, London, the body of an unknown soldier representing the heroic dead of the British nation. The following year the United States chose the body of an unknown American soldier from the cemeteries of France, arranging to have it lie in state under the Capitol dome at Washington, D.C., November 9 and 10. An estimated ninety thousand Americans paid homage to the unidentified warrior, who was buried with solemn ceremony on Armistice Day, 1921, at Arlington National Cemetery. A perpetual guard of honor is maintained at this grave. Belgium interred at the base of the Colonnade of the Congress at Brussels, on November 11, 1922, one of its nameless fallen. Several other European countries have similar memorials. The individual soldier chosen in each case is without identification as to name, rank, or organization, and even the battlefield where he was slain is not known.

UNRRA. See NATIONS, UNITED.

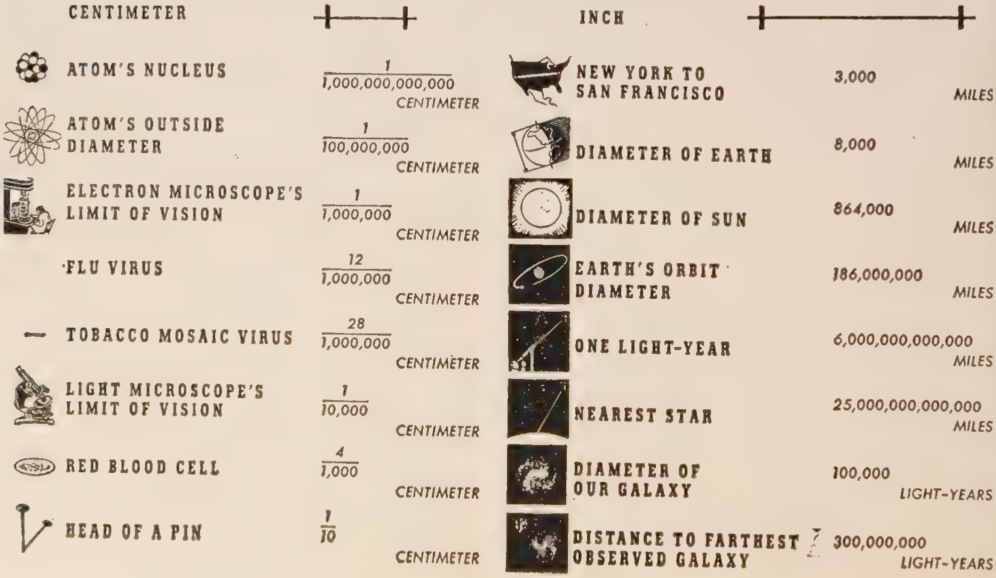
UPAS, *yu'pus,* a tree native to Java and some other places in the East Indies. It yields a violently poisonous milky juice which the natives use on arrow tips.

UPHOLSTERY, *up hohl'stur ih,* the name

Courtesy *Life Magazine*

MAN HAS TAKEN MEASURE OF ATOMS AND GALAXIES

SHOWN BELOW IS A SCALE OF THE DIMENSIONS OF THE UNIVERSE AS SO FAR MEASURED BY MAN. IT RANGES FROM THE DIAMETER OF AN ATOM'S NUCLEUS, AS THE UNIVERSE'S INSIDE DIMENSION, TO THE DISTANCE TO THE FARTHEST GALAXY RECORDED BY ASTRONOMERS.



CENTIMETER	┼──┼
ATOM'S NUCLEUS	$\frac{1}{1{,}000{,}000{,}000{,}000}$ CENTIMETER
ATOM'S OUTSIDE DIAMETER	$\frac{1}{100{,}000{,}000}$ CENTIMETER
ELECTRON MICROSCOPE'S LIMIT OF VISION	$\frac{1}{1{,}000{,}000}$ CENTIMETER
FLU VIRUS	$\frac{12}{1{,}000{,}000}$ CENTIMETER
TOBACCO MOSAIC VIRUS	$\frac{28}{1{,}000{,}000}$ CENTIMETER
LIGHT MICROSCOPE'S LIMIT OF VISION	$\frac{1}{10{,}000}$ CENTIMETER
RED BLOOD CELL	$\frac{4}{1{,}000}$ CENTIMETER
HEAD OF A PIN	$\frac{1}{10}$ CENTIMETER
INCH	┼────┼
NEW YORK TO SAN FRANCISCO	3,000 MILES
DIAMETER OF EARTH	8,000 MILES
DIAMETER OF SUN	864,000 MILES
EARTH'S ORBIT DIAMETER	186,000,000 MILES
ONE LIGHT-YEAR	6,000,000,000,000 MILES
NEAREST STAR	25,000,000,000,000 MILES
DIAMETER OF OUR GALAXY	100,000 LIGHT-YEARS
DISTANCE TO FARTHEST OBSERVED GALAXY	300,000,000 LIGHT-YEARS

given to many furnishings of a room, especially chairs and sofas. In an upholstered chair or sofa, the seat and often the arms and back are padded for greater comfort. Upholstering is handwork, and the value of a piece of upholstered furniture depends upon the skill of the workman and the amount of time he spends on the job, as well as on the kind of materials used. Upholstered chairs first appeared in Europe in the sixteenth century.

A well-made chair starts with a frame of durable wood. The upholsterer begins his work by stretching strips of jute or linen webbing across the seat from back to front and tacking them in place, leaving not more than two inches of space between them. He then adds a set of crosswise webbing that passes over and under the first. At each point where the strips cross, he sets a coil spring and sews it to the webbing with twine.

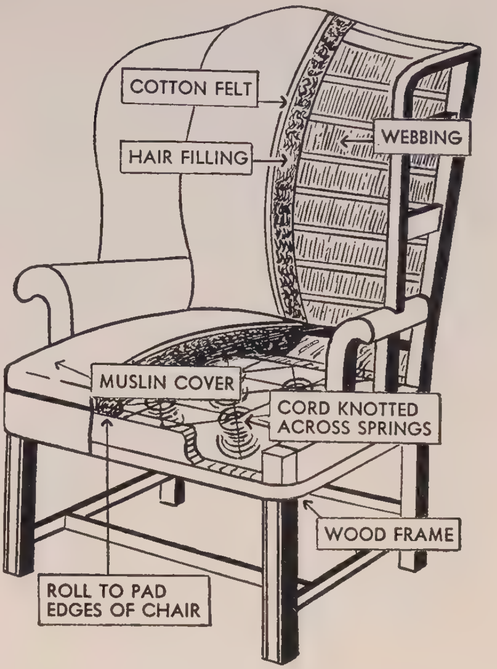
Next he fastens a piece of twine to the edge of the seat and passes it over the top of a row of springs, tying it twice to each coil and pulling it evenly so that the springs are pressed down to the right height. This process is repeated for each row, in both directions, and in especially good furniture diagonal rows are added, so that each coil is tied eight times. A cover of burlap is tacked over the springs and sewed down with twine. If the springs are close to the front edge of the chair, a wire is fastened along the top of the coils at the front, so that the edge will be firm. If the springs are farther back, the upholsterer makes a strong edge by fastening a tightly stuffed roll of burlap along the front of the frame.

Stuffing of horsehair, moss, kapok, tow, sponge rubber, foam rubber, rubberized hair, or other fibers is placed on the burlap covering, distributed evenly, and covered with a second piece of burlap, which is tacked at the edges and quilted roughly to the stuffing. Over this goes a layer of felted cotton or of down, and this is then covered with muslin or with the decorative fabric or leather that is the final covering.

The back and arms of a chair are handled in the same way. The back often has springs like those of the seat, and small springs may be used in the arms, which are heavily padded. Rolls of stuffing help to keep all edges firm.

Springs are a modern development in upholstery, and furniture is also often upholstered in the older way by the use of padding and stuffing alone. Sometimes leather or some other strong material is stretched across the frame of the chair, and no padding is used. In early times this was a common way of making a chair.

Sewing is usually done with double-pointed or curved needles. The upholsterer has many other special tools, such as webbing stretchers, skewers, and trimming knives. The fabrics are fastened to the frame with small tacks. Chairs and sofas are sometimes *tufted* or *buttoned* after the final cover has been put in place. See also FURNITURE; INTERIOR DECORATION; TEXTILES.



UPLAND PLOVER. See SANDPIPER.

U′RAL MOUNTAINS, a long mountain range of great value to the Soviet Union and forming part of the boundary between Europe and Asia. To the northwest, on the Arctic islands of Novaya Zemlya, are peaks which belong to the range. The Urals wind their way south for about 1,500 miles, continuing through the Mugodzhar Hills to a point between the northern ends of Lake Aral and the Caspian Sea. The Kirgiz Steppe crosses the southern extension of the range. Mount Narodnaya in the north, with an altitude of 6,185 feet, is the tallest of the Urals, which are generally low and rounded. Over most of its length the range is less than a hundred miles wide. This ancient range has been a natural asset of immense importance to the Russians. Although the northern Urals are cold and bleak, growing only low shrubs and mosses, vast forests blanket the slopes farther south. Mineral deposits range from building stone to precious gems and include iron, platinum, asbestos, gold, silver, copper, lead, zinc, nickel, manganese, salt, potash, and chromium. Oil wells in the Urals, as well as mines, contributed greatly to Soviet successes in World

War II. Railroad and industrial centers include Molotov, Sverdlovsk, Chelyabinsk, Magnitogorsk, and Ufa.

URAL RIVER, a waterway of the Soviet Union in Europe and Asia. It rises in the southern Ural Mountains and flows more than 1,400 miles to the Caspian Sea. Its course runs south to Orsk and then generally west, past the commercial and industrial center and rail depot of Chkalov. Beyond Uralsk the river flows south, entering the Caspian at Gurev. It is of little value for navigation. Quantities of sturgeon are obtained from the stream, which is crossed by several Soviet railroads.

URANIA, *yoo ra′nih uh.* See MUSES.

URA′NIUM, a silver-white metallic element that has become tremendously important as a source of atomic energy (see ATOM; ATOMIC ENERGY; TRANSMUTATION OF ELEMENTS). It occurs throughout the world in small concentrations in many minerals. The richest uranium-bearing mineral is the black or brown *pitchblende,* which is also the chief source of radium. It is a variety of *uraninite,* a mixture of the dioxide and the trioxide of uranium, usually found at great depths in the earth.

The principal sources of pitchblende available to the United States, Canada, and England are the Shinkolobwe mine in the Belgian Congo and the Eldorado mines at Great Bear Lake and Lake Athabaska in western Canada. The Joachimsthal mines in the Erz Mountains on the German-Czechoslovakian border are under Russian control. Deposits of *carnotite,* a yellow mineral in which uranium is combined with vanadium and potassium, are found in many areas in the Colorado Plateau, which covers parts of Colorado, New Mexico, Utah, and Arizona. Intensive exploration has led to discoveries of pitchblende in Montana, northern Michigan, and Idaho. These and other uranium ores occur also in Bulgaria, Russia, Sweden, and Cornwall, England. Other promising sources of the metal are the gold ores of the Witwatersrand region of South Africa and the phosphate rocks of Florida, Idaho, and Wyoming, from which it is possible to get uranium as a by-product of the production of phosphate fertilizers.

Properties. The chemical symbol for uranium is U, the atomic number 92, atomic weight 238.07, and melting point 1133°C. It is one of the heaviest metals, having a density 18.68 times that of water. In every 1,000 parts of ordinary uranium there are 993 parts of the U-238 isotope, 7 parts of U-235, and 0.06 part of U-234 (see ISOTOPES). The U-235 nucleus undergoes fission when bombarded by slow neutrons; that is, it splits into two fragments and releases great quantities of energy. The isotope U-238 is a "fertile" one that is transformed in nuclear reactors into plutonium, which is also fissionable by slow-neutron bombardment. Uranium must be handled with care because it is chemically poisonous. It is also radioactive, the first member of a series of naturally radioactive elements, each of which emits alpha or beta particles or penetrating gamma rays.

Compounds. Uranium forms the olive-green oxide (U_3O_8), the black dioxide (UO_2), and the yellow-red trioxide (UO_3). These compounds are used in coloring and decorating glass and porcelain; sodium uranate (Na_2UO_4) gives such materials a yellow glaze. Uranium compounds also have uses as antiseptics and as photographic toning materials.

URANUS, *yu′ruh nus,* who represented the heavens in Greek mythology, was the husband of Ge, or Gaea (earth), and the father of the Titans and Cyclopes. The gods of Olympus were his grandchildren. Fearing his children, he imprisoned them in Tartarus. But Cronus (Saturn to the Romans), encouraged by his mother, freed himself and wrested the throne of heaven from his father. In some versions of this myth, the drops of Uranus' blood that fell upon the earth during the struggle were changed into giants. See also MYTHOLOGY.

URANUS, the large planet moving around the sun at an average distance of 1,782,000,000 miles, is so far from the earth that it is never much brighter than the faintest stars visible to the naked eye. Its orbit lies beyond Saturn's, and it is extremely cold. Uranus, discovered in 1781 by Sir William Herschel, was the first planet found with the telescope; the bright ones were all known in early times. Uranus has a diameter of 32,000 miles, but its average density is only a little greater than the density of water. Like the other giant planets it rotates rapidly, turning on its axis in 10¾ hours. The period of its revolution around the sun is eighty-four years. In the telescope Uranus looks like a small greenish disk. It has a very deep atmosphere containing a large amount of the gas methane. Below the atmosphere, which may be liquid or solid at a depth of a few hundred miles, is a thick layer of ice surrounding the solid core of the planet. The axis of Uranus is tipped so far that the poles lie almost in the plane of its orbit. It has five satellites, which revolve around Uranus in the plane of its equator and in the direction of the planet's rotation, traveling almost at right angles to the motion of Uranus in its path around the sun. Uranus was named after the Greek god of the sky, the father of the Titans. See also ASTRONOMY; JUPITER; NEPTUNE; PLANET; SATURN; SOLAR SYSTEM.

URBAN, the name of eight popes, the most important of whom are the following.

Urban II, who was pope from 1088 to 1099, was a French nobleman who rose in the Church until he became a close associate of Pope Gregory VII. As pope, Urban continued the reforms begun by Gregory and strengthened the Papacy. He called several councils to discuss church problems, and at Clermont in 1095 he preached the First Crusade (see CRUSADES, THE). He died just before the news of the capture of Jerusalem reached Rome.

Urban V, pope from 1362 to 1370, was born in southern France. He was a patron of learning and helped to found several universities. In 1367 he went to Rome from Avignon, hoping to bring the papal court back to its traditional home, but after three years he returned to Avignon, where he died. He was beatified in 1870.

Urban VI, an Italian who was elected pope in 1378, brusquely announced a program of reform and so angered many of the cardinals that they promptly named an antipope, Clement VII, in his place. This split the Church into factions and created the Great Schism, which lasted for fifty years. Urban died in 1389.

Urban VIII, a member of the Barberini family of Florence, was pope from 1623 to 1644. He founded the College of Propaganda for the training of missionaries, and he made a number of reforms in church organization. He built the Barberini Palace in Rome and commissioned Bernini to design the canopy over the great altar of St. Peter's.

UREA, *yoo re'uh,* or **CARBAM'IDE,** a white crystalline substance that occurs in nature as the end product of the processes (metabolism) by which protein foods are utilized in man and other mammals. It is excreted by the kidneys as a waste product. Large quantities of urea are produced synthetically for industrial purposes; it is a compound of carbon, oxygen, nitrogen, and hydrogen with the chemical formula $CO(NH_2)_2$.

Uses. The nitrogen content of urea makes it a valuable fertilizer; it also has uses in cattle feeds and as a medicine. Several of its compounds are drugs used for inducing sleep or relieving pain. But its chief use is in the production of urea-formaldehyde resins of the thermosetting type, which are not softened by heat after once being "set" or "cured" under pressure and some heat.

These resins are used in the textile industry to increase the strength, resilience, and crease resistance of fabrics and to control their luster. They increase the wet strength of paper when added to the pulp during manufacture. One variety of the resin is added to lacquers and other coatings used for hard, baked-enamel finishes on such products as automobiles and washing machines. The resins also make water-resistant, colorless, and nonstaining adhesives used for gluing joints and wood veneers for furniture, and for bonding plywoods and other laminated materials built up of layers of paper, cloth, or wood.

Molded plastic articles made from urea-formaldehyde resins are odorless, tasteless, hard, strong but brittle, and are not dissolved by water or alcohol. They come in a wide variety of colors, some transparent or translucent, and others made opaque by fillers of wood pulp or cotton fibers. Among these molded plastics are buttons and buckles; bottle tops; handles for stoves and cabinets; compacts; boxes; tableware; clock, razor, and instrument cases; and radio cabinets.

Urea itself is very soluble in water and alcohol. Its preparation in 1828 by the German chemist Friedrich Wöhler was the first time an organic substance was compounded in the laboratory from inorganic materials, that is, from materials that had not been obtained from living matter. See also CHEMISTRY, *Organic Chemistry.*

URE'MIA, a poisonous condition resulting from the accumulation of waste matter in the blood. Normally such harmful products are removed from the blood by the kidneys and are carried off in the urine. But when the kidneys become badly damaged or when the blood circulation through the kidneys is slowed down, uremia often develops. Uremia may occur in people with nephritis, kidney infections, kidney cysts, heart failure, shock, severe burns or crushing injuries, mercury or carbon tetrachloride poisoning, or obstruction of the tubes (ureters) which carry the urine from the kidneys to the bladder. The chief symptoms are weakness, restlessness, headaches, loss of weight and appetite, nausea, vomiting, itching, anemia, twitching muscles, disturbances of vision, and coma. Uremia can be cured only if the underlying cause is discovered and remedied. See also KIDNEYS.

U'REY, HAROLD CLAYTON (1893-), American physical chemist, best known for his discovery of deuterium, a heavy isotope of hydrogen (see ISOTOPES). He was born in Walkerton, Ind. Urey received the B.S. degree from the University of Montana, the Ph.D. from the University of California, and was the American-Scandinavian Foundation fellow (1923-24) to the University of Copenhagen, where he studied under the noted physicist Niels Bohr. He was a member of the faculty at Johns Hopkins and Columbia universities and, after 1945, at the University of Chicago.

His fields of interest and research have included the structure of atoms and molecules, the thermodynamic properties of gases, the separation of the isotopes of a number of elements, the composition of the earth and moon (in connection with studies of the origin of the solar system), and the development of methods for finding the temperatures of the seas in earlier geological times from the relative amounts of the oxygen-18 and oxygen-16 isotopes in certain fossil sea shells. On the atom-bomb project during World War II he was in charge of research for separating the uranium-235 isotope by the gaseous diffusion process and for production of heavy water. He has been honored by memberships in foreign scientific societies and by the award of the Willard Gibbs, Davy, and Franklin medals and the Nobel prize in chemistry (1934). He was editor of the *Journal of Chemical Physics* (1933-40) and author of *The Planets: Their Origin and Development,* and, with A. E. Ruark, of *Atoms, Molecules and Quanta.*

URINE, *yu'rin,* a liquid excreted by the kidneys. Urine actually represents waste products of the body. These are extracted from the blood by the kidneys, and the resulting urine travels through a tubelike *ureter* leading from each kidney to the urinary bladder. When the bladder is filled, the urine is released from the body by way of a tube called the *urethra.* Urine consists of 96 per cent water and 4 per cent solid matter. The main components of the solid matter are urea, sodium chloride, sulfuric and phosphoric acids, potassium, ammonia, uric acid, magnesium, and calcium.

Normal human urine is clear, yellow, and slightly heavier than water. The average healthy adult excretes between two and three pints in twenty-four hours. The amount, however, varies considerably with the volume of blood in the body. For example, if a person drinks large amounts of water, the blood volume is increased and the urine output is greater. On the other hand, too small an intake of fluid, high fever, excessive perspiration, or other conditions lower the blood volume and therefore decrease the amount of urine excreted. Since abnormal products of the body are also excreted in the urine, an examination of urine helps in the diagnosis of certain diseases, such as diabetes and kidney diseases. See also KIDNEYS.

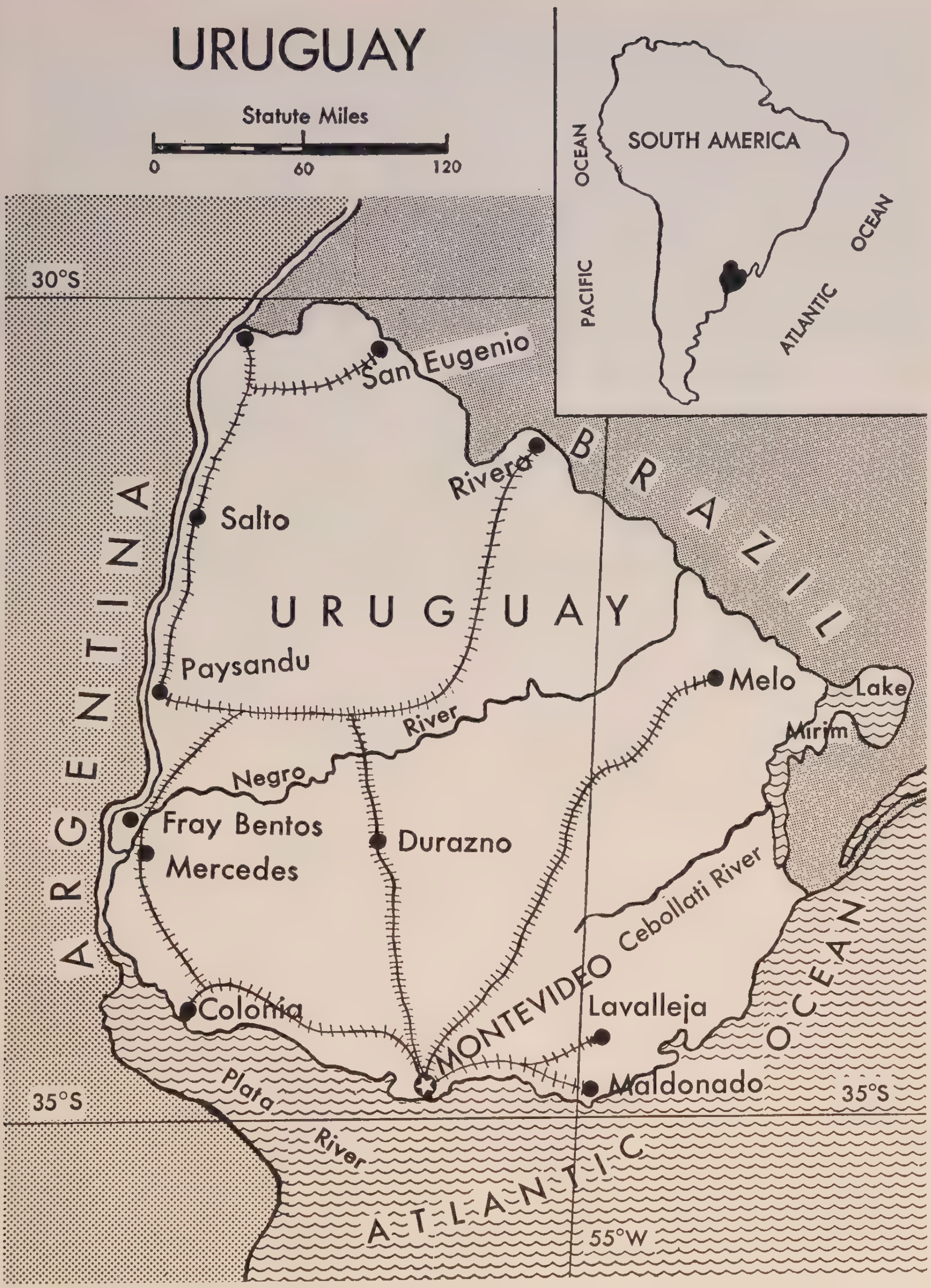
UR'SA MAJOR and **URSA MINOR,** constellations in the northern sky, are perhaps the most familiar groups of stars in the heavens. The seven bright stars of Ursa Major make a pattern resembling a dipper, and the constellation is often called the Big Dipper. The English know it as Charles's Wain (Wagon), but long ago the Chaldeans gave it the name of the Great Bear. The two brightest stars, which mark the edge of the dipper opposite the handle, point in the direction of Polaris, the North Star, about thirty degrees to the north. The star Mizar, at the bend of the handle, has a faint companion, Alcor, which is visible to keen-eyed observers.

THE BIG DIPPER AND LITTLE DIPPER were the Great Bear and the Lesser Bear to the ancients, who named the constellations after characters in their folk tales and myths.

Ursa Minor, or the Lesser Bear, is also shaped like a dipper, with Polaris at the end of the handle. Except for Polaris, the stars of the Little Dipper are much fainter than those of Ursa Major. For observers north of latitude 40°, these two constellations and others close to the celestial pole never disappear below the horizon. See also ASTRONOMY; CONSTELLATION.

URSULA, *ur'soo luh,* SAINT, a Roman Catholic saint believed to have been martyred about the year 238, whose story first attracted widespread attention in the twelfth century. According to tradition, Ursula was the daughter of a Christian British king and had taken a vow of virginity. Both beautiful and learned, she demurred at marrying the pagan prince who sought her hand. Prompted by a vision, Ursula asked for a delay of her nuptials and assembled some 11,000 virgins whom she led on a long, arduous pilgrimage to Rome. At Cologne she and all her adherents were slain by the barbarous Huns. The details of the story of Ursula are purely legendary, but church scholars generally agree that there took place at Cologne in the third or fourth century a massacre of Christian virgins by the Huns. See also URSULINES.

URSULINES, *ur'soo linz,* or **NUNS OF SAINT URSULA,** a Roman Catholic sisterhood founded by St. Angela Merici at Brescia, Italy, in 1535. The first religious order of women instructors, the Ursulines soon became known as highly qualified, progressive teachers. In 1639 they established their first convent in Quebec, and in 1727 they opened an Ursuline house in New Orleans.



Ursuline convents or missions are to be found today throughout Europe and the United States, as well as in Java, South America, China, and Alaska. Total membership in the various Ursuline branches numbers approximately 4,500. Their principal work is the teaching of children and young women in parochial schools and colleges.

URUGUAY, *yoor'uh gwy,* officially EASTERN REPUBLIC OF THE URUGUAY, is the smallest independent country of South America. It is widely recognized as one of the most

Ewing Galloway, N.Y.

BEYOND THE BUSY WATERFRONT stretches the harbor of Montevideo, Uruguay's capital city.

stable and progressive of all the Latin-American countries.

Location and Surface Features. Uruguay is situated on the southeastern coast of South America between two very large countries—Brazil to the north and Argentina to the south and west. It is a heart-shaped country with an area of 72,172 square miles, or about the size of North Dakota. Its boundaries are the Atlantic Ocean on the east, the Uruguay River on the west, the broad inlet known as the Río de la Plata (River Plate) on the south, and the Jaguarão River and Lake Mirim on the northeast. The point where the Quaraí River flows into the Uruguay River in the northwest marks the meeting place of Brazil, Argentina, and Uruguay.

Uruguay's central and southern sections are broad, rolling, grass-covered plains like the plains, or pampas, of Argentina; its northern section, covered by low, forested ranges, is a continuation of the Paraná Plateau of Brazil. The Negro is the most important of the rivers draining the interior. A chain of fine sandy beaches along the coast has made Uruguay one of the most popular resort countries in the Western Hemisphere.

Climate. Sea breezes give Uruguay a generally mild and pleasant climate. The seasons are the reverse of those in the Northern Hemisphere; January is the warmest month and June the coolest. During the winter, when the strong, cold wind called the *pampero* sweeps across from the Andes in the west, the temperature sometimes drops to freezing. The annual rainfall amounts to about forty inches and rain is heaviest in May and October. The purple prairie flowers and purplish mists of springtime have given Uruguay its nickname — the "Purple Land."

The People and Their Activities

Population. With a population of about 2,500,000, Uruguay is the most densely populated country in South America. Montevideo, the capital, is Uruguay's largest city. Most of the people are of European stock, the descendants of settlers from Spain, Italy, Portugal, France, Germany, and Great Britain. The speech, manners, and general culture of the country show a strong Spanish influence. Although most of the people are Roman Catholics, there are also Protestants of various denominations. There has been a separation of Church and State since 1919.

Farming. Rich grasslands cover almost 80 per cent of Uruguay's area, and livestock raising is the chief occupation. Sheep and beef cattle supply wool, hides, skins, grease, tallow, chilled beef and mutton, and other products which make up more than 70 per cent of the nation's exports. The cattle are tended by herdsmen called *gauchos,* long famed for their daring horsemanship. Horses, donkeys, mules, hogs, goats, and dairy cattle are also raised on the grasslands.

The chief field crops of Uruguay, raised mostly in the well-watered southern and southwestern sections, are wheat, corn, oats, barley, rice, peanuts, potatoes, flax (raised for linseed), and tobacco. The northwest is noted for its fruits, which include grapes for wine making. Vegetable gardening is carried on around the larger cities.

Mining. Uruguay is not rich in minerals. Granite and marble are used as building stone; limestone goes into the making of portland cement; and there are small amounts of gold, silver, copper, lead, manganese, iron, and lignite in the northern highlands. Agates, opals, and amethysts are among the semiprecious stones used in jewelry, and sand, gravel, and clay are available for local glass, brick, tile, concrete, and terra-cotta manufacture.

Manufacturing. Meat processing has long been carried on in Montevideo, Paysandú, and Salto, and leather tanning, shoe manufacturing, and candlemaking are related industries. The textile mills of Montevideo use domestic wool for their woolen fabrics and import raw materials for making cottons and rayons. There are also oil refineries, flour mills, breweries, paper mills, chemical works, tobacco plants, and furniture shops. A huge hydroelectric power plant on the Negro River has speeded industrial growth.

Transportation. Besides Montevideo, its chief seaport, Uruguay has important shipping centers on its navigable waterways — the Río de la Plata, the Uruguay, and the lower course of the Negro. From the capital, 1,900 miles of state-owned railroad tracks extend to trading hubs in the interior. Of the 10,000 miles of improved roads the most important stretch is Uruguay's section of the Pan American Highway. All the larger cities are served by domestic airlines, and several international ones serve Montevideo.

Government and Education

Government. Under the constitution of 1934, Uruguay elected for four-year terms a President and a legislative assembly, or Congress, consisting of a Senate and a House of Representatives. The President chose a Council of Ministers, or Cabinet, made up of the heads of the nine government departments. In 1951 both houses of the assembly approved a constitutional amendment abolishing the Presidency and setting up a nine-man Federal Council invested with the powers formerly held by the President. This change of procedure was also approved by a popular vote. Under the amendment the Council represents the nation in all domestic matters and foreign relations. Executive decrees must be signed by the chairman of the Council, and Council members are responsible to the assembly, which may force their resignation by censuring them. Members are chosen by the two political parties receiving the highest number of votes, in proportion to the party voting strength. The Senate (of thirty members) and the House of Representatives (of ninety-nine members) were retained, as well as the Cabinet of department heads. The assembly appoints the five members of the Supreme Court for ten-year terms. The country is divided into nineteen departments, each of which is administered by an elected governor called an intendant and by a legislature called a junta.

Education. Since 1877 Uruguay has made elementary education free and compulsory for all children between six and twelve years of age. Education is also free to all in secondary, normal, and technical schools and at the University of the Republic of Montevideo. Uruguay has one of the lowest illiteracy rates in South America, and Montevideo, with its libraries, museums, concert halls, and lecture forums, is one of the cultural centers of the continent.

History

Although Juan Díaz de Solís, a Spanish navigator, discovered Uruguay in 1516, the first successful attempt by Europeans to establish a settlement was not made until 1680, when Portuguese pioneers set up Colonia. The Spanish founded Montevideo in 1726, despite the fierce opposition of the native Charruan Indians. Fifty years later the Spanish drove out the Portuguese and attached Uruguay to the Viceroyalty of Río de la Plata as the *Banda Oriental,* or Eastern Shore of the River Plate.

Following the lead of the other Plate states, Uruguay, under the leadership of José Gervasio Artigas, revolted against the mother country in 1811. In 1814 the rebels set up an independent state, but in 1820 the Portuguese seized control of Uruguay and made it the Cisplatine Province of Brazil. The Argentines helped the Uruguayans regain their independence during the revolution of 1825-27, and in 1830 the republic of Uruguay was launched. Great Britain supported the little nation as a "buffer state" which would prevent either Argentina or Brazil from gaining full control of the important River Plate.

For the next seventy years Uruguay was troubled by political conflict between the Colorados (Reds) and the Blancos (Whites), which later became the modern Liberal and Conservative parties. These political groups brought Uruguay into wars with Argentina (1843-51) and Paraguay (1865-70). Peace and order were finally established after José Batlle y Ordóñez became President in 1903. Thereafter the government took over the operation of many banks, insurance companies, hotels, and industries. The progressive laws affecting labor and social welfare which the General Assembly put into effect earned tiny Uruguay its reputation as "the social laboratory of the Americas." The republic has taken part in international affairs as a member of the League of Nations, the United Nations, and the Organization of the American States. See also Montevideo; Río de la Plata; Uruguay River.

URUGUAY RIVER, an important waterway in South America, rises in southeastern Brazil and flows west, southwest, and south for about a thousand miles. In its lower course, after receiving the Río Negro, it joins the Paraná to form the Río de la Plata, a very broad estuary of the Atlantic Ocean. The Uruguay forms part of the boundary between Argentina and Brazil and the entire boundary between Argentina and Uruguay. It is navigable for large ships as far as the city of Paysandú, Uruguay, and for small vessels as far as the falls at Salto, more than a hundred miles upstream. See also Uruguay.

USO. See United Service Organizations.

U.S.S.R. See Russia.

USURY, *yu'zhoo rih,* interest higher than the legal rate charged for the use of money. In Bible times *usury* and *interest* had the same meaning. The Mosaic law forbade the Jews to charge their "brothers" for the use of anything, though they could "lend upon usury" to aliens. Bans against interest charges continued quite generally in Europe until nearly the end of the Middle Ages. Later, after moneylending for profit had become a regular business practice, usury laws were passed to protect borrowers from ruinous interest rates. In the United States, legal interest charges in any state are usually established by the state legislature. In a few states maximum contract rates of interest are provided for by the state constitutions. A majority of the legislatures have also enacted special laws applying only to small loans, since borrowers of small sums of money are the most liable to become victims of "loan sharks" and dishonest moneylenders. It is customary, too, to enact legislation exempting certain lenders from the usury laws and to set up specific interest rates for them. These lenders include industrial banks, pawnbrokers, credit unions, and building and loan associations. Penalties for violating usury legislation range from loss of the overcharge to loss of the entire loan, and sometimes to imprisonment. See also Interest.

UTAH, the "Beehive State," is a symbol of what hard work and courage can accomplish. Forced westward because of their beliefs, the religious sect known as the Mormons turned a desert wasteland into a productive farming area with prosperous industrial centers. The struggle of the Mormons to find a home and make it livable is one of the heroic tales in American history, and Utah, the state which developed from their settlements, has led the way in reclaiming the barren lands of the Southwest.

Location and Surface Features. Utah is bounded by Idaho and Wyoming on the north, Colorado on the east, Arizona on the south, and Nevada on the west. Nearly half the state, including the southern and east-

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Total Area: 84,916 square miles, including 2,570 square miles of inland water.

Rank in Size: Tenth.

Population (1950): 688,862.

Density of Population: 8.36 persons per square mile.

Rank in Population: Thirty-eighth.

Chief Cities: Salt Lake City (capital, 182,121), Ogden (57,112), Provo (28,937), Logan (16,832).

How Acquired: Mexican cession (1848).

Date of Admission to Union: 1896.

Noted for: Farming, ranching, mining.

Nickname: Beehive State.

Flower: Sego lily.

Tree: Blue spruce.

Bird (unofficial): Sea gull.

Song: "Utah, We Love Thee"; words and music by Evan Stephens.

Motto: Industry.

Seal: A shield on which is perched an American eagle with outspread wings, and the top of which is pierced by six arrows. The shield is flanked on each side by the American flag and bears the state motto. Beneath the motto are a beehive and bunches of sego lilies and the date of Mormon settlement, 1847. The circular border contains the words: The Great Seal of the State of Utah, 1896.

Flag: The shield, surmounted by an eagle and flanked by American flags, appears within a circle in the center of a dark-blue field which has a gold border. The flag bears both the date of Mormon settlement, 1847. and the date of statehood, 1896.

ern parts, is a great upland, carved into valleys and canyons by the Colorado River and its tributaries, the most important of which is the Green River. This region is known both as the Colorado Plateau and as the Red Desert, because of its red sandstone mesas, or flat-topped hills. Strange sandstone formations in the southeast have been set aside as the Arches, Capitol Reef, Rainbow Bridge, and Natural Bridges national monuments. In the southwest are Cedar Breaks National Monument and Zion and Bryce Canyon national parks, with their scenic wonders.

The Wasatch Mountains, a part of the Rocky Mountain system, form the "backbone" of Utah. A belt of fertile land thirty miles wide, extending along the western slopes of these mountains, is the most important farming strip in the state. King's Peak (13,498 ft.) in the Uinta Mountains to the east of the Wasatch Range is the highest point in Utah.

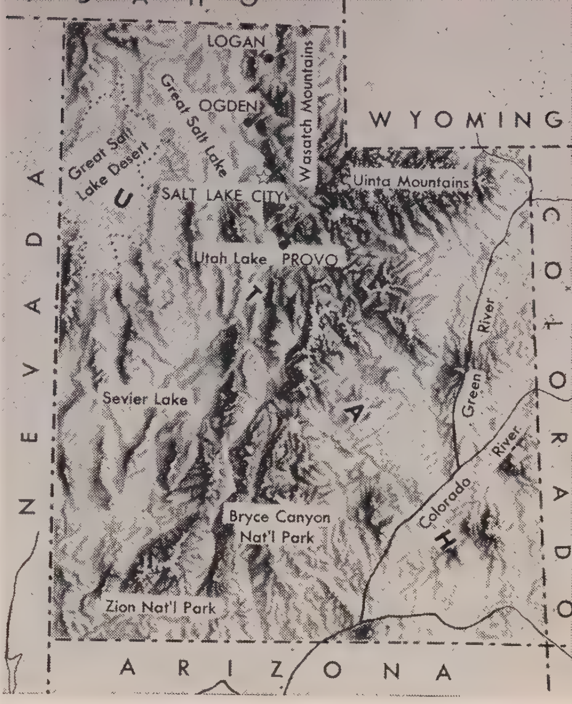
The Green Desert in western Utah gets its name from the many plants — sagebrush, greasewood, yucca, and creosote bushes — which grow there. This region forms the eastern part of the Great Basin of the American West. The land rises in separate mountain ranges and sinks in depressions which contain the Great Salt Lake and the Sevier deserts and the Bonneville Salt Flats. Among the major rivers of this section are the Sevier, which formerly drained into Sevier Lake, but whose waters are now utilized entirely by several storage dams; and the Jordan, which links Utah Lake and Great Salt Lake. Sevier Lake today is dry.

Climate. In general Utah's climate is mild and dry, but winters are very cold in the central mountain area and summers are very hot in valleys of the southwest. While forty-one inches of rain and snow fall each year in the Wasatch and Uinta mountains, a scant 4.5 inches of rain strike the western deserts annually.

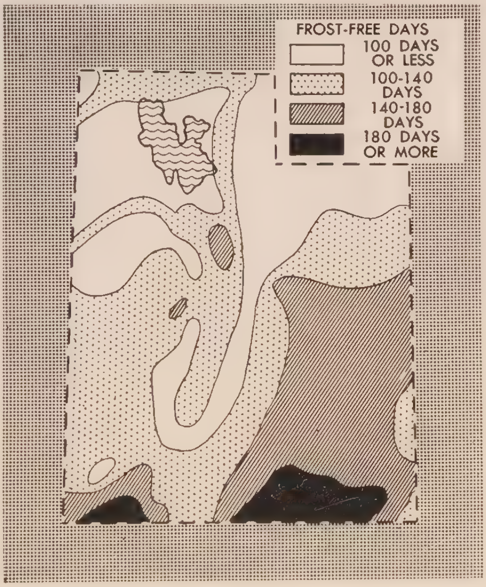
The People and Their Activities

The People. Utah was the first and only American state in which settlers established colonies according to a regular system. The followers of Brigham Young and other Mormon leaders were the first white men to develop irrigation and dry farming scientifically within the United States. They also worked together under the co-operative system and laid out some 350 towns in accordance with a definite plan. Today about 70 per cent of the people of Utah belong to the Church of Jesus Christ of Latter Day Saints (Mormon). The original Mormon settlers came from states to the east.

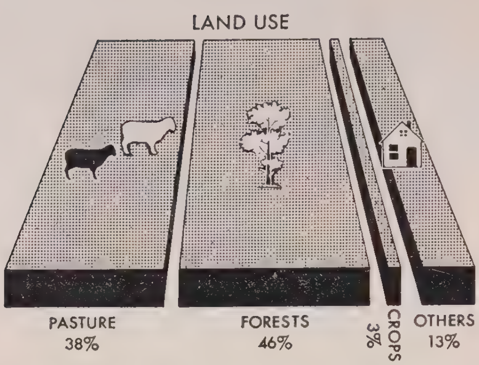
The first non-Mormon settlers were European immigrants to the California gold fields, some of whom remained in Utah. Later came other Europeans and Mexicans. Native Ute, Paiute, and Shoshone Indians now make their homes on reservations.



Farming. Utah has been an agricultural state ever since its founding. Rich, irrigated farmlands are found around Utah and Bear lakes and in a number of river valleys. Although these lands make up only a tenth of the total farm area, they yield excellent crops of wheat, alfalfa, and sugar beets.



UTAH'S GROWING SEASON is very brief in mountain and desert areas, much longer along the Colorado River.



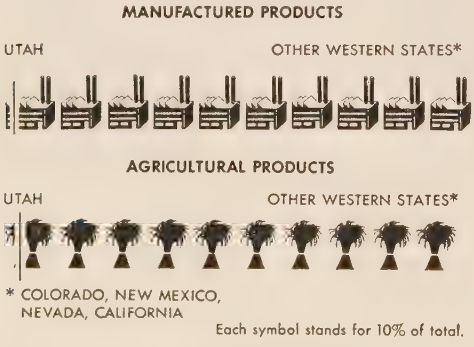
GRAZING LANDS COVER VAST AREAS in Utah, and the crop-growing region, while small, produces a very rich yield.

Minerals in the soil give a special flavor to orchard fruits and vegetables. The warm temperatures of the Virgin and Santa Clara valleys favor the raising of cotton, sorghums, figs, and melons. Much of the winter wheat, corn, oats, and barley is raised by dry farming in sections where the rainfall, though scant, is uniform enough for the soil to keep a certain amount of moisture.

Sheep are raised on the Colorado Plateau. Utah ranks fifth among the states in wool production. The state's other livestock includes beef and dairy cattle, horses, hogs, goats, and poultry.

Mining. Utah ranks high in the production of gold, silver, lead, uranium, and zinc, but its most valuable metal is the copper taken chiefly from the open-pit mines in the Bingham Canyon district. Deposits of bituminous coal are extensive; and common salt, asphalt, sulfur, potassium salts, iron ore, natural gas and petroleum, carbon dioxide, gas, marble, granite, and limestone all have commercial importance.

Manufacturing. The chief food industries of Utah are meat packing, sugar refining, canning, flour milling, and the processing of dairy products. Copper smelters, iron and steel mills, and salt refineries use the raw materials from Utah's mines. Woolen textiles, furniture, bricks, chemicals, and machinery are a few of the many and varied products of the state's industrial plants. The centers of manufacturing are Salt Lake City, Ogden, and Provo.



AMONG THE WESTERN STATES Utah ranks fifth in the value of its agricultural products and third in the value of its manufactures.

Transportation. The rail center of Ogden and the great airline terminal, Salt Lake City, help to make Utah the transportation hub of the Mountain West. The state has about 1,800 miles of railroad tracks and almost 9,000 miles of improved roads and highways.

Government and Education

Government. The legislature of Utah consists of twenty-three senators elected for four-year terms and sixty representatives elected for two years. It meets in January of odd-numbered years in Salt Lake City, the capital. The governor, secretary of state, attorney general, state treasurer, state auditor, and superintendent of public instruction all serve four-year terms. The chief justice and four associate justices of the state supreme court serve for ten years. Each of the twenty-nine counties is administered by a three-member commission, while most of the cities have mayors.

Education. Thanks to the Mormons' respect for education, Utah has long had a high literacy rate. Elementary and secondary schooling is free and compulsory for all children up to the age of eighteen. The major institutions of higher learning are the University of Utah in Salt Lake City, the Utah State Agricultural College in Logan, Weber College in Ogden, and the Brigham Young University, maintained in Provo by the Mormon Church.

History

Probably the first white men to visit Utah were Spaniards sent out by Coronado in 1540 to find the Seven Cities of Cibola (see Coronado, Francisco Vásquez de). Franciscan monks and American fur trappers had been in the region before it was explored and mapped by John Charles Frémont in 1843. It was a part of the territory ceded to the United States by Mexico at the close of the Mexican War. In 1847 the Mormons sought a refuge there from the persecution they had suffered in the Middle West. Their advance company blazed the Mormon Trail from Council Bluffs, Iowa, to the Great Salt Lake Valley. A church government developed under Brigham Young, who was elected president of the Mormon Church and governor of the Provisional State of Deseret, as Utah was first called. Congress in 1850 made it the Territory of Utah. It was named after the Ute Indians.

Because Mormon men, in accordance with the laws of their religion, married several wives, Congress refused for many years to make Utah a state. Finally, in 1890, a constitution was drawn up which outlawed such marriages and separated the Mormon Church from the state government. In 1896 Utah entered the Union. Thereafter it developed rapidly, increasing its agricultural and industrial production and enjoying an excellent reputation for prosperity, orderliness, and progress.

Utah's Interpreters

T.B.H. Stenhouse's historical work *Rocky Mountain Saints,* Brigham Henry Roberts' history of the Mormon Church, and John Henry Evans' biography *Joseph Smith, An American Prophet,* as well as the novels *Children of God* by Vardis Fisher and *The Giant Joshua* by Maurine Whipple, tell of Utah's Mormon founders and of the early days of settlement. The sculpture of Mahonri Young and many of the paintings of George Ottinger, John Hafen, and other artists were inspired by the beliefs and history of Mormonism.

Related Articles. Consult the following titles for additional information:

Colorado River	Paiute (Indians)
Dry Farming	Parks, National
Frémont, John Charles	Polygamy
Great Salt Lake	Salt Lake City
Irrigation	Shoshone (Indians)
Mexican War	Smith, Joseph
Mormons	Ute (Indians)
Ogden	Young, Brigham

Books for Reading and Reference

Buff, Mary Marsh and Conrad. *Peter's Pinto, A Story of Utah.* Viking. Fun and adventure on a Utah ranch, climaxed by the discovery of a wild pinto pony.

Fisher, Vardis. *Children of God.* Grosset. Story of the Mormons.

Utah; a Guide to the State. Hastings House. (American Guide Series.)

Whipple, Maurine. *This Is the Place.* Knopf. History and description of the state; well illustrated.

UTE, a tribe of buffalo-hunting Indians, speaking a Shoshonean language, who once occupied western Colorado and adjacent territory in Utah and New Mexico. Originally these Indians lived in domed grass houses. Their scanty clothing was generally made of sagebrush, though they sometimes wore deerskins. After getting horses from the early Spanish settlements, they soon became a typical Plains tribe, living in tepees, dressing in skins, and riding into the plains to hunt buffalo. There are now about a thousand on reservations in Utah, Colorado, and Arizona. The state of Utah takes its name from the Ute Indians.

U'TICA, an ancient Phoenician city in North Africa, situated on the western coast of the Gulf of Tunis. Although long subject to Carthage, it was able to maintain some independence, and when Carthage was destroyed in 146 B.C., during the Third Punic War, Utica was made the capital of the Roman province of Africa. It was at Utica that Cato the Younger killed himself, after Caesar's victory over Pompey in 46 B.C. The Arabs destroyed the city in the seventh century. Utica was excavated in 1869, and today the ruins lie inland, fifteen miles northwest of modern Tunis. See also Rome, History of.

UTICA, N. Y., a city known especially for the manufacture of textiles, is situated on the Mohawk River and the New York State Barge Canal, near the geographical center of the state. To the north are the foothills of the Adirondacks; mountain streams furnish water and hydroelectric power to the city. About one third of the American output of knitted underwear comes from the Utica textile mills, which also turn out large quantities of cotton cloth, knit fabrics, sheets, pillowcases, and rayon yarn. Other plants manufacture men's clothing, firearms, heating apparatus, air compressors, fishing equipment, and paper products. There are a number of good schools, colleges, and institutes for technical training. Utica was settled after the Revolution and incorporated as a village in 1798. The opening of the Erie Canal in 1825 hastened its development as an important trading and shipping point, and it was chartered as a city in 1832. The establishment of woolen mills in 1847 and cotton mills a year later set the pattern for the city's economy. The population is about 101,000.

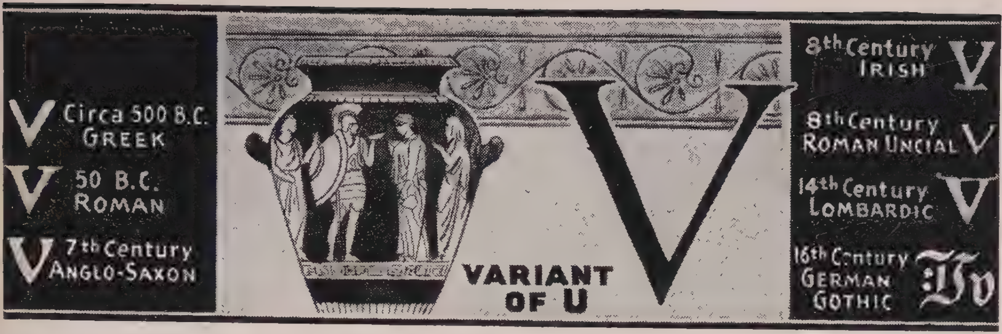
UTILITAR'IANISM, the system of ethics that defines right and wrong in terms of the effects or results of any act, in contrast to those ethical systems which hold that the will or intention of the person who performs the act determines its moral quality. According to the principles of utilitarianism, good actions are those that increase the total happiness or well-being of mankind. This philosophy was given its classic formulation by John Stuart Mill in his famous essay, *Utilitarianism.* Though it is no longer highly regarded as philosophical theory, its liberalizing influence on English political life is beyond dispute.

UTOPIA, *yoo to'pih uh,* the name invented by Sir Thomas More for an imaginary island he described in his most famous book. The word is derived from two Greek words meaning *nowhere.* In More's *Utopia,* which was published in 1516, he drew his picture of the ideal society in which men would be just, free, and happy. Many other philosophers have set down their own visions of the good society, and the name utopia has come to mean any such picture of the ideal. Some authors have used the device satirically, in order to point out the sharp contrast between life as it might be if human beings were capable of perfection, and life as it is. See also MORE, SIR THOMAS.

UTRECHT, *yu'trekt,* PEACE OF, a series of treaties signed in the city of Utrecht on April 11 and July 13, 1713, at the end of the War of the Spanish Succession. Supplemental treaties were signed in 1714. The principal nations involved in the war were Great Britain, Holland, and Austria on the one hand and, on the other, France and Spain. By the terms of the Treaty of Utrecht, Great Britain recognized Philip of Anjou, grandson of the French king Louis XIV, as the rightful king of Spain, with the provision that France and Spain should never be united under one ruler. The French withdrew their support of the Stuart pretenders and recognized the House of Hanover as the royal house of England. France ceded the Hudson Bay territory, Nova Scotia, Newfoundland, and St. Kitts to Great Britain, and from Spain the British got Gibraltar and the island of Minorca. Austria acquired the Spanish possessions of Sardinia, Milan, Naples, and the Spanish Netherlands; the Duke of Savoy received the kingdom of Sicily; and Prussia was acknowledged as a kingdom by the other powers. The treaties signed at Utrecht marked the rise of Great Britain as the leading sea power and the greatest commercial nation in the world. See also SUCCESSION, WARS OF.

UTRECHT, THE NETHERLANDS, an old and picturesque city about twenty miles southeast of Amsterdam and slightly farther from Rotterdam, is on the Oude Rijn (one of the many branches of the Rhine) and on the Vecht, which is made to flow through a series of canals. Rivers and canals are crossed by nearly one hundred bridges. Utrecht is the capital of the small but densely populated province of Utrecht, the seat of a university founded in 1636, and an archbishop's see. There are several museums and art galleries, fine parks, and many old churches, two of them dating from the eleventh century. The national Mint is at Utrecht, and there is some industry, especially in textiles, but the city is chiefly residential. Utrecht was founded in pre-Roman times and was a flourishing commercial town in the Middle Ages. The Union of Utrecht, which established the Dutch Republic, was signed in the city in 1579, and in 1713-14 the series of treaties that closed the War of the Spanish Succession were concluded in Utrecht (see UTRECHT, PEACE OF). The population of the city is about 190,000.

UZ'BEK SOVIET SOCIALIST REPUBLIC. See RUSSIA.



V, the twenty-second letter of the English alphabet, was used interchangeably with *u* in Latin, and in English until the seventeenth century. The sound of *v* is always the same, and the letter which is most closely allied to it is *f*, with which it is often interchanged in related languages. In English this close connection of the two letters is shown by the plural of such words as wi*f*e, wi*v*es; hal*f*, hal*v*es.

As a Roman numeral, V means five; with a line above it, it stands for 5,000.

VACATION SCHOOLS. The long summer vacation for public-school pupils, especially in the congested sections of cities where there are no playgrounds, has been found to be anything but beneficial to the children. Many of the large cities now maintain schools in such centers for a portion of the vacation, and these are known as vacation schools. Some of the branches taught are the same as those in the regular course of study, but usually more time is given to industrial training and to recreation. The girls are taught sewing and cooking; the boys, woodwork or some other occupation. Some schools offer work of the regular term for pupils who failed of promotion. In schools having a large number of pupils of foreign parentage, special emphasis is placed upon English reading and composition and upon correct pronunciation.

VACCINATION, *vak se na′shun,* usually refers to a method of preventing smallpox. When a person is vaccinated, a physician inserts into his skin the virus which causes cowpox, a disease related to, but less severe than, smallpox. Vaccination is based on the experiment made by Edward Jenner, an English physician, in 1796. Jenner transferred vaccine matter from a dairy maid infected with cowpox to the arm of an eight-year-old boy who then developed a pox. Later the boy was inoculated with smallpox but did not develop the disease. He was protected. The value of vaccination in preventing the highly disfiguring and fatal disease of smallpox was quickly appreciated and spread throughout the civilized world. As a result of its use, outbreaks of smallpox are now rare and usually confined to communities in which the number of unvaccinated persons is exceptionally high.

Several satisfactory methods of vaccination are now used. The most common method is to introduce the virus by rubbing it gently into scratches which are made on the upper arm or upper leg. If the vaccination proves successful, a small inflamed area appears about the third or fourth day and increases in size until the tenth day, at which time a pustule forms. This dries up and forms a scab which later falls out, leaving a small scar in the skin. The vaccine is preserved in lymph obtained from a calf or sheep. To secure continued immunity, repeated vaccinations at intervals of five to seven years are desirable in most cases.

The term vaccination is sometimes used to describe attempts at artificial immunization against other diseases, such as typhoid, whooping cough, and yellow fever. For such diseases, vaccination consists in injecting killed or weakened viruses or germs. See GERM THEORY OF DISEASE.

VACCINE THERAPY, *vak′seen ther′a pi,* a method of medical treatment for combating diseases caused by bacteria. The treatment is based upon the principle that injection into the system of killed bacteria that produce the disease will develop in the blood another sort of bacteria that will destroy the disease-producing bacteria. The vaccines are usually prepared by placing some fluid of the body containing the disease-producing bacteria in some substance in which the bacteria will grow rapidly, then purifying this "culture" and treating it with a preservative. The vaccine is injected hypodermically, and works in a few hours. This method of treatment is successful in such diseases as carbuncle, ulcers, typhoid fever, tuberculosis and asthma. See SERUM THERAPY.

VAC'UUM, a term usually applied to a space from which air or other gases have been exhausted. An absolute vacuum is impossible, since however completely the gases may be exhausted, the space will still be filled with ether (see ETHER). However, in the ordinary use of the term, a vacuum is said to be produced when the air is removed from space as completely as possible by means of an air pump. Such vacuums are sufficiently perfect for common experiments. The most perfect vacuum formed in practice is that above the mercury in a barometer tube, produced by filling the tube with mercury and allowing it to settle until the column sustained is equal to the weight of an equal column of atmosphere (see BAROMETER). Other practical applications of the vacuum are found in the vacuum brake and the vacuum pan. See AIR BRAKE.

VACUUM CLEANER, a device for removing dust from floor coverings, walls and hangings by means of rolling brushes and air suction. Small cleaners propelled by hand or capable of being attached for power to electric sockets are in use in individual households. For larger buildings an air pump mounted on a truck and run by a gasoline engine may go from door to door, carrying the dust to a box in the truck by means of a large hose. Office buildings are commonly equipped with stationary engines, run by gasoline or electricity and operating a pump connected with a system of pipes leading to the different floors.

The use of the vacuum cleaner is a distinct advance in the matter of sanitation, as the former method of sweeping with brooms scattered the dust and was a means of spreading contagion.

VALDAI, *val di'*, **HILLS**, a group of hills in West Central Russia, forming the chief watershed of that part of Europe. They consist of hills and plateaus, with an average altitude of about 1,200 feet. Formerly covered with forests, they are now cleared and cultivated. They contain the sources of the Volga, the Dnieper, the Don and the Duna.

VALENCIA, *val len'she ah,* SPAIN, the third city in population in the country, situated on the west coast, three miles from the Mediterranean Sea. Its history dates to 138 B. C. It was destroyed by Pompey of Rome, and was captured by the Visigoths in 413 and by the Moors in 714. From 1021 to 1238 it was the capital of an independent Moorish kingdom. In its modern aspect it is a picturesque mixture of Moorish architecture and modern streets and plazas. The University of Valencia, founded in 1411, is one of the foremost in Spain. The harbor is secure and well equipped to accommodate commerce, and the city is an important railway center. The leading industry is the manufacture of silk, and the place is also noted for the making of colored tiles. Fruit raising is extensively carried on in the surrounding country. Population, about 544,000.

VA'LENS (328–378), Roman emperor of the East, associated in power with his brother Valentinian I. The chief event of Valens' reign was a war with the Goths, who, driven southward by the Huns, had received permission to settle on Roman territory. Irritated, however, by the treatment they received at the hands of the Roman officials, they soon took up arms and destroyed Valens and the greater part of his army.

VAL'ENTINE, SAINT, a saint of the Roman calendar, said to have been martyred in A. D. 306. The custom of choosing valentines on his day (February 14) has been accidentally associated with his name. On the eve of Saint Valentine's day, young people of both sexes used to meet, and each of the men drew from a number of names of the opposite sex. Each gentleman thus got a lady for his valentine, and he became the valentine of a lady, to whom he was bound to be faithful for a year. A similar custom prevailed in the Roman Lupercalia, to which the modern custom has, with probability, been traced. The day is now celebrated by sending, usually through the post, sentimental or ludicrous missives, especially prepared for the purpose.

VALENTIN'IAN I (321–375), on the death of Jovian, in 364, chosen emperor of Rome by the army, therefore one of the "barracks emperors." He shared the empire with his brother Valens, who ruled in the East. Although chiefly occupied throughout his reign in repelling invasions of the barbarians, he proved himself a firm and just ruler, instituting many political and social reforms. His sons, Gratianus and Valentinian II, succeeded him.

VALENTINIAN III, Roman emperor from 425 to 455. He was made emperor by Theodosius II, his grandfather, but never really exercised the imperial power, leaving it in the hands of his mother, Placidia, until her death in 450, and then largely in the hands of the eunuch Heraclius. Although the barbarians who were constantly harassing the empire were repeatedly defeated by Aëtius, general of the army, Spain, Africa, Gaul and other provinces were lost to Rome during Valentinian's reign, and the empire grew steadily weaker. Valentinian was assassinated.

VALE'RIAN, a medicinal plant, native to Europe and Northern Asia, growing abundantly by the sides of rivers and in ditches and moist weeds. The aromatic, volatile oil obtained from its roots is used as a stimulant in the treatment of nervous and circulatory disorders.

VALHAL'LA, in Old Norse mythology, the palace of immortality, inhabited by the souls of heroes slain in battle, and carried hither by the swift Valkyries. Here they spent their time in drinking and feasting and fighting furious battles; their wounds, though often serious, were healed every night. The name Valhalla is applied figuratively to any edifice which is the final resting place of many heroes. See VALKYRIES.

VALKYRIES, *val kir' eez*, in Old Norse mythology, the maiden attendants of Odin, who, at his command, rode over battlefields and bore the souls of the bravest of the slain to Valhalla, Odin's great hall. Here the Valkyries waited upon the heroes, serving them mead in vessels made from skulls. The Valkyries were sometimes regarded as the personification of clouds, especially of storm clouds. See VALHALLA.

VALLADOLID, *vahl ya do leed'*, MEXICO. See MORELIA, MEXICO.

VALLEJO, *val ya'ho*, CALIF., a city of Solano County, situated on the northeastern shore of San Pablo Bay, twenty-three miles northeast of San Francisco, on the Southern Pacific railroad. It has a fine, deep harbor, which admits the largest ocean ships, and is an important shipping point for grain. Its leading establishment is the Mare Island Navy Yard. There are also flour mills and tanning yards. The city is built on the slopes of a hill, and the surrounding country is devoted to the raising of fruit. The public institutions include an orphans' home, Saint Vincent's Academy, a sailors' clubhouse, a Carnegie Library and a city hall. The city was founded in 1851 with the intention of making it the capital of the state. The legislature met here in 1851, in 1852 and for a time in 1853. The commission form of government was adopted in 1911. Population, about 26,000.

VAL'LEY, low land between mountains, hills or bluffs. The largest and most important valleys have been formed by the upheaval and folding of the earth's crust. Such valleys are found among mountain systems, and are called *intermontane* valleys. They are long and narrow, and their floor may have an elevation several hundred or several thousand feet above the sea level. The simplest valleys of this sort are found in the Jura Mountains, where the strata were not broken in folding and where the slopes are remarkably uniform and even. Many of the so-called basins in the Rocky Mountains plateau are also valleys formed by the folding of strata, but most of these are irregular and are caused by transverse ranges, showing that the movements by which they were formed were very complex.

Art Institute of Chicago

RAKHAM'S VALKYRIE BRUNHILDE

Valleys running parallel to the mountain ranges are known as *longitudinal* valleys, those running across the ranges are *trans-*

verse valleys. Transverse valleys may be due to breaks in the folded strata, but most of them have been formed by erosion. They are usually narrow, with very steep sides, and the floor is only wide enough for the stream which flows in it. When of high altitude these valleys are known as *passes.* Among the most celebrated of these passes are the Khyber Pass in the Himalayas and the Simplon Pass. When of low altitude, transverse valleys are frequently known as *water gaps,* as the Delaware Water Gap.

Valleys in volcanic regions are usually due to volcanic action and are found in the side or on the summit of mountains, around the crater. They are small and of comparatively little importance. *River* valleys are formed by erosion, but their location was first determined by the formation of mountains and valleys by folding. Glacial valleys are those which have been formed or modified by the action of glaciers. They are found in mountainous regions, and most of them were undoubtedly river gorges, previous to the glacial period. The lochs and firths of Scotland are good illustrations.

Drowned valleys are those partially under the sea, and are formed by the lowering of the coast. The fiords of Norway, Delaware Bay and the Gulf of Saint Lawrence are good examples.

Related Articles. Consult the following titles for additional information:

Canyon	Glaciers
Fiord	Mountain

VALLEYFIELD, QUE., on the Canadian National and the Saint Lawrence & Adirondacks railways, is the western terminus of the Beauharnois Canal. The town has large cotton and flour mills, paper, biscuit, gasoline motor, glove, clothing and cigar factories. It is the seat of a Roman Catholic bishop. Considerable lumbering and iron mining are done in the vicinity. Population, about 22,000.

VALLEY FORGE, a village in Chester County, Pa., famous as the site of the quarters of the American colonial army under George Washington in the winter of 1777 and 1778. The army was 11,000 strong when it went into camp, December 17, but owing to mismanagement on the part of the quartermaster-general and the commissary department the supplies were totally inadequate, and fully half the men were soon unfit for duty. The suffering of the soldiers during the winter and following spring was almost incredible and tried the patriotism of even the most loyal friends of the colonial cause. Washington remained with his men throughout this period and with the aid of Baron Steuben finally reorganized the army and restored its morale. Camp was broken June 18, 1778.

Part of Valley Forge camping ground is now included in a state memorial park. The tract of rolling wooded country is about twenty miles northwest of Philadelphia, on the Schuylkill River. The old stone house which Washington made his headquarters contains many interesting war relics, and there has been erected an impressive Washington Memorial, consisting of a beautiful chapel, a tower with a carillon, and the Cloister of the Colonies. The stained glass windows of the chapel commemorate persons and events of the Revolution. Other interesting features of the park include an equestrian statue of Anthony Wayne and a memorial arch dedicated to the soldiers who perished at Valley Forge.

VALOIS, *val wah′*, a dynasty ruling in France from 1328 to 1589, having its origin in the circumstances by which Philip III, in 1285, gave the county of Valois to his younger son, Charles. Upon the extinction of the Capet dynasty, in 1328, the eldest son of this Charles of Valois ascended the French throne as Philip VI. The elevation of the House of Valois to the throne of France gave rise to the series of long and bloody conflicts with England known as the Hundred Years' War.

VALPARAISO, *val pa ri′zo,* CHILE, the capital of the province of Valparaiso and the chief port of the country, situated on the Pacific Ocean, sixty-eight miles northwest of Santiago. It has a commodious harbor, protected by a newly-constructed breakwater, and is connected by regular lines of steamers with leading American and European ports. It is strongly fortified, and has a large naval arsenal.

Back of the harbor rise hills and mountains, on the lower slopes of which is the newer residence portion of the city. The lower town contains the business section and city park. The buildings are mostly constructed of stone and are of a substantial character. The educational institutions include a naval school, a number of colleges and a school for marines. The city maintains a hydrographic bureau and a museum of natural history. The industrial establishments include foundries, machine shops, bottling works, distilleries, sugar refineries and railroad shops. The principal exports are grain, wool, leather, guano, saltpeter and copper; the imports are textile and other manufactured and mineral products.

Valparaiso was founded by Juan de Saavedra in 1536. It has been visited by several disastrous earthquakes, the latest being that of August 16 and 17, 1906. Population, about 215,600.

VALPARAISO UNIVERSITY, an educational institution at Valparaiso, Ind. It was founded in 1873 as the revival of the Valparaiso Male and Female College (Methodist, 1859-69), and has been under the control of the Lutheran University Association since 1925. The university is composed of a college of arts and sciences, a school of law and a summer session. Under a co-operative arrangement with Purdue University, Valparaiso offers the first two years of civil, electrical, mechanical and chemical engineering. A five-year co-operative plan in journalism is in effect with the Medill School of Journalism. The average enrollment is 1,400, and the faculty numbers eighty-six. The libraries contain about 40,000 volumes.

VALUE. See Supply and Demand.

VALVE, a device, as a cap, ball or slide, for the purpose of controlling the flow of liquids, steam, gas or loose material through pipes, tubes or chutes. As to the method of their operation, most valves may be included in this general classification: (1) valves opened and closed by hand; (2) those operated by independent mechanism; (3) those operated by mechanisms connected with the machine whose operation they control; and (4) those opened and closed by the motion of the fluid whose flow they control. Valves may rotate, rise and fall from their seats or open and close by sliding on and parallel to their seats. In the human anatomy the loose flap or fold of lining membrane which regulates the flow of the blood and other bodily fluids is called a valve. See Pump; Steam Engine.

VAM'PIRE, in Slavic folklore, a corpse which leaves its grave during the night and sucks the blood of living human beings, particularly of young people and children. The victims gradually lose strength and finally die from no apparent malady, while the corpse retains the appearance of a living being. The belief in vampires is an ancient one, fostered by the medieval Greek church as a means of terrifying the people into godly behavior. It still persists in the locality of the lower Danube, where heretics, outcasts and criminals are still supposed to become vampires at death. Figuratively, a vampire is a person who in any way preys on another. Kipling's poem *The Vampire* characterizes the parasitic woman.

VAMPIRE BAT, a Central and South American bat which takes its name from the habit of some of the species of sucking the blood of cows, horses and even men, attacking them in their sleep. These bats are of small size, are tailless, and have a pair of upper incisors elongated and sharpened to pierce the skin of their victims. They have gullets so small that only a liquid diet is possible, and the intestinal canal is modified to accommodate a diet of blood. The destructive qualities of these bats, however, have been greatly exaggerated.

VANA'DIUM, a silvery-white, very hard metallic element. It occurs in nature only in combination with other minerals. The principal commercial use of vanadium is in the manufacture of a special alloy steel used in tools and automobiles; for this it is especially suitable since the presence of vanadium in the alloy makes the steel remarkably hard and tough and increases its elasticity and ability to resist shock. Some of the vanadium compounds are used in making dyes and black inks. Vanadium pentoxide is an important catalytic agent.

The United States and Peru together produce about two thirds of the world's vanadium, the remaining third coming almost entirely from Southwest Africa and Northern Rhodesia. Colorado, Utah, Arizona, New Mexico and Idaho are sources of vanadium in the United States.

VAN BUREN, Martin (1782–1862), an American statesman, eighth President of the United States. He was the close friend and the successor of Andrew Jackson, to whom he owed his nomination by the Democrats.

Van Buren was totally unlike his imperious, outspoken predecessor. He was slight of figure, courteous and soft-spoken; yet beneath his placid manner lay individuality, a firm will and a strong character. Tactful and conciliating as he was, Van Buren could fight doggedly for principle, and notwithstanding his strong sense of party loyalty, he could break with his party when his conscience so dictated. His administration is noteworthy chiefly for the establishment of the independent treasury system, the result of his own tireless efforts. At the time he gained little credit for this achievement, but historians of to-day find this the outstanding feature of his career as President.

Early Life. Martin Van Buren was born at Kinderhook, Columbia County, New York, on December 5, 1782. He was the son of a small farmer. He attended the local schools until he was fourteen, after which he became office boy for a neighborhood lawyer, rising to the positions of clerk, copyist of pleas and special pleader in the constables' courts. After six years of such training he entered a New York law office, and in 1803 was admitted to the bar. He then entered into a partnership with his half brother, James Van Allen, in Kinderhook, where he was soon a conspicuous figure in local Democratic (then called Democratic-Republican) politics. Within the next few years Van Buren advanced rapidly in his profession, becoming probate judge in Columbia County, in 1808, and holding that position until 1813.

Political Advancement. In 1812 Van Buren was elected to the state senate of New York, and in 1815, while still a member of that body, was appointed attorney-general. He was reëlected to the senate for the term 1816–1820, but lost his position as attorney-general in 1819 because of a political disagreement with Governor De Witt Clinton. Throughout this period he was steadily gaining in power of leadership, and in 1820 was successful in securing the reëlection of Rufus King to the United States Senate. The following year he himself won a seat in that body.

Van Buren remained in the Senate until 1828, when he was elected governor of New York. In the Senate he had favored strict construction of the Constitution on all questions, and as a member of the finance committee and chairman of the judiciary committee he had made a good impression by his sincerity and moderation. His career as governor is of special interest to-day, in that he advocated two principles whose wisdom is more appreciated at present than in his time. In the first place he opposed free banking, and advocated a system whereby all the state banks would become "mutual insurers of each other's soundness." This plan is a feature of the present Federal Reserve system. Secondly, he recommended that state and national elections be separated. While this principle has not been extensively adopted, its soundness is generally accepted.

In the Presidential election of 1828, Van Buren effectively supported Andrew Jackson, whom he warmly admired, and in 1829 the latter rewarded him with the most important place in his first Cabinet, that of Secretary of State. Van Buren retained this office long enough to settle a disagreement between England and the United States with respect to the trade of the West Indies.

He resigned in 1831 and soon accepted the post of minister to England, but as a bit of party politics the Senate Whigs succeeded in holding up the nomination after the appointee had sailed. It was known in political circles that Van Buren had resigned in order not to jeopardize his chances for the Presidential nomination in 1836, to which he was looking forward. The Whigs hoped to discredit him by their maneuver, but the pretext which they used was so feeble that their act served only to increase Van Buren's popularity. In 1832 he was elected Vice-President on the ticket with Jackson, and was in line for the nomination for President on the expiration of Jackson's second term. The Whigs were badly split, and in the electoral college in 1836 the party vote was divided among William Henry Harrison, Hugh L. White of Tennessee, Daniel Webster and W. P. Mangum of South Carolina. Van Buren had 170 votes against seventy-three for his nearest rival, Harrison.

Administration. As Vice-President, Van Buren consistently supported Jackson and his policies, and on taking over the Presidential office he reappointed most of Jackson's Cabinet. In his inaugural address he gave an indication of his attitude on the slavery question when he stated that he would oppose abolition of slavery in the District of Columbia if the slave states opposed it; and he promised not to interfere with slavery where it was practiced. Early in his administration he had to meet a serious financial crisis. President Jackson, in 1833, had removed the funds of the government from the United States Bank, practically putting an end to the institution, which he regarded as a symbol of the "money power." The funds had been distributed among certain "pet banks," which used them in unsound speculation. Subsequently, Jackson issued a "specie circular" requiring that gold and

Administration of Martin Van Buren, 1837-1841

I. THE PRESIDENT
  (1) Birth
  (2) Education
  (3) Early career
  (4) Later life
  (5) Character
  (6) Death
II. THE PANIC OF 1837
  (1) Causes
    (a) Over-speculation in land
    (b) Expenditures for internal improvements
    (c) Panic in England
    (d) Failure of the wheat crop
    (e) Wild-cat banking
  (2) Effects
    (a) High prices of necessaries
    (b) Bank and brokerage failures
    (c) Business failures
    (d) Distress among the poor
    (e) Suspension of specie payments
  (3) Led to independent treasury
III. DOMESTIC AFFAIRS
  (1) Slavery agitation
    (a) Riots and demonstrations
      (1) Murder of Lovejoy
      (2) Garrison mobbed in Boston
  (2) Second Seminole War
    (a) Skirmishes and raids
    (b) Capture of Osceola and other chiefs
    (c) Zachary Taylor's force defeats Indians at Okechobee swamp
  (3) Oregon settlements
    (a) Mostly by Hudson Bay Company
    (b) Americans were missionaries
  (4) The Mormons in Missouri
    (a) Control of the government by the Mormon church
    (b) Troubles at Kirtland
    (c) Driven out of Missouri
  (5) Riots and disorder
    (a) The "buckshot" war
    (b) The "broad seal" war
    (c) Anti-rent or "patroon" war
    (d) Canadian rebellion
      (1) Attempts to enlist American aid
      (2) Strict neutrality of the United States
      (3) The Caroline affair
  (6) Great inventions and discoveries
    (a) Friction matches, 1838
    (b) Magnetic telegraph
    (c) First photograph taken
    (d) Vulcanized rubber
IV. QUARREL WITH MEXICO
  (1) Causes
    (a) Property of Americans in danger
    (b) United States vessels seized
    (c) United States citizens imprisoned and executed
  (2) Mexico resented recognition of Texan independence
V. ELECTION OF 1840
  (1) Issues
  (2) Candidates

Questions on Van Buren

When was Martin Van Buren born? In what state?

What profession did he adopt?

What public offices did he hold before 1837?

What can you say of his abilities and character?

What were the principal causes of the panic of 1837? Give details of each as far as you can.

What were some of the immediate effects of the panic?

What is meant by the independent treasury or subtreasury system?

Who was Elijah Lovejoy? Where did he live?

Give a brief summary of the career of William Lloyd Garrison.

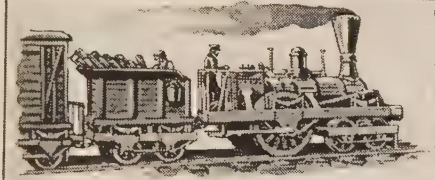
What future President took a prominent part in the second Seminole War?

Who was the founder of the Mormon sect?

Name three inventions perfected during Van Buren's administration.

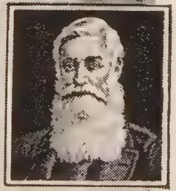
THE ADMINISTRATION OF
MARTIN VAN BUREN

EIGHTH PRESIDENT OF THE UNITED STATES—1837 to 1841


IMPROVED AMERICAN TYPE LOCOMOTIVE

POLITICAL CARTOON: TRYING TO FORCE SPECIE PAYMENTS

FIRST DAGUERREOTYPE PHOTOGRAPHY IN AMERICA, 1839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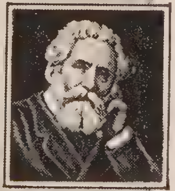
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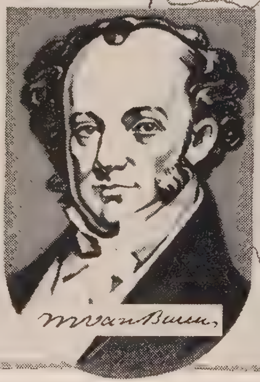
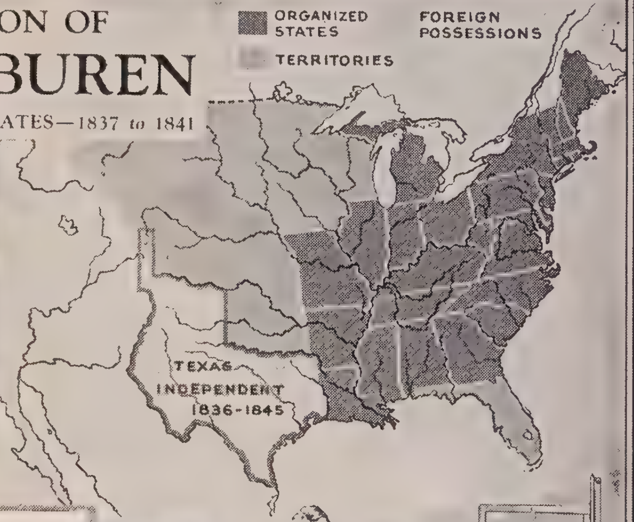
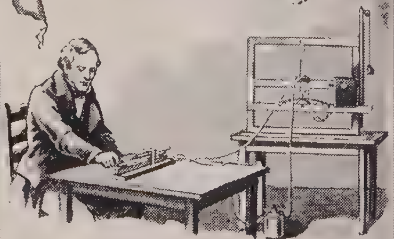




SPARKS

PARKMAN


FIRST MORSE MAGNETIC TELEGRAPH

FRICTION MATCHES BLESSED MANKIND

President Van Buren's term was overshadowed by America's first major depression, the Panic of 1837. Lasting until 1843, it contrasted sharply with the exuberance of the Jackson era, though it was the logical penalty for the intoxicating optimism and spending frolic of the preceding decade. However, from this national disaster rose the stern demand for a sounder financial regime. This was fulfilled in the Independent Treasury system, then inaugurated.

The panic restored the Whigs to power by laying an unmerited discredit upon the name of Van Buren. But the American spirit, undaunted, pressed forward in railway development, steam navigation and epochal inventions. Labor prospered. Social optimism expressed itself in such utopias as Brook Farm. A group of famous writers of history revealed the growing importance of the United States in the affairs of the world.

POPULATION, 1840, 17,069,453.

silver be paid for public lands, which drained the banks of their reserves and caused many failures. It was a period of credit inflation, reckless issuance of paper money and extravagant expenditures for public improvements, and in 1837, shortly after Van Buren began his term, a disastrous panic overwhelmed the nation.

The President called Congress in special session and in his first message, September 1, 1837, outlined his policy. After explaining the causes of the panic, he presented his plan for an independent treasury, whereby the control of national finances would be divorced from private banking and the government would be the custodian of its own funds, as it is today. For three years he labored to have this policy adopted; not until July, 1840, did he succeed in persuading a reluctant Congress to pass the law which he regarded as a sort of "second Declaration of Independence." Except for a short interval under the Whig regime, the independent treasury has remained a permanent national institution.

Though the financial issue overshadowed all others, it is not true that Van Buren's term was in other respects uneventful. The slavery issue, becoming yearly more entangled with politics, was the cause of such disturbances as the murder of Elijah Lovejoy at Alton, Ill., and the mobbing of the great abolitionist, William Lloyd Garrison. There were outbreaks in New York against the landlords, or patroons, and in Missouri against the Mormons; in Florida a desperate war with the Seminoles was waged. A rebellion in Canada and the establishment of the republic of Texas caused disturbances along the international boundaries, north and south.

Van Buren was not responsible for these conditions, but they reacted against him, and with the prevalent hard times served to make his administration and the Democratic party extremely unpopular. He also alienated many voters by refusing to aid the Canadian rebels, though time has vindicated his attitude of strict neutrality. Considerable material progress is recorded of the period. In 1837 the magnetic telegraph was invented; friction matches were first used in 1838; in 1839 the first photograph was taken in America. In 1839, too, the process of vulcanizing rubber was invented by Charles Goodyear.

Van Buren was a candidate for re-election, but his administration was connected with too much that was disagreeable, and he was defeated. He secured but sixty electoral votes, to 234 for the Whig candidate, William Henry Harrison. Calmly accepting his defeat, he retired to his country seat of Lindenwald in his native county.

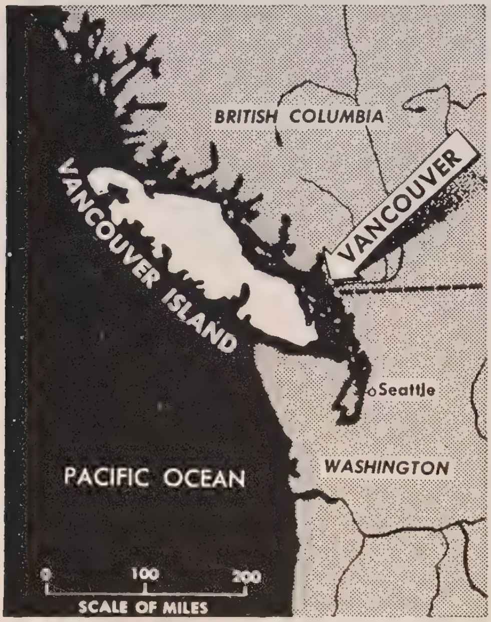
As Ex-President. Van Buren by no means disappeared from the public eye during the last two decades of his life. In 1844 he took a firm stand against the annexation of Texas, thus losing the Democratic nomination for the Presidency, and within the next three years he came out definitely against the extension of slavery. In 1848 the faction of the Democratic party which upheld the Wilmot Proviso (which see) nominated him, against his wishes, for the Presidency, and the nomination was confirmed by a convention of "Free-Soilers." The regular Democrats nominated Lewis Cass, from whom Van Buren pulled enough votes to give the election to Zachary Taylor. Van Buren received about 300,000 popular votes, but he carried no state. He remained a Democrat to the end of his life, but his sympathy for the anti-slavery cause made him a firm supporter of Lincoln after the outbreak of the Civil War. He died in the second year of the struggle, and was buried at Kinderhook, N. Y.

Related Articles. Consult the following titles for additional information:

Garrison, William Lloyd
Lovejoy, Elijah P.
Political Parties in the United States
Seminole
Texas (history)
Treasury Department

VANCOUVER, *van koo'vur,* **B. C.,** the third largest city of Canada, the industrial and cultural center of the province, and one of the most important seaports on the continent. It is situated on Burrard Inlet, an arm of the Strait of Georgia, opposite Vancouver Island. The city is the western terminus of two great transcontinental railroads, the Canadian Pacific Railway and the Canadian National Railways, and of the British Columbia Electric Railway, which extends to Chilliwack and New Westminster. The city is also served by several airlines and highways. Vancouver has one of the best harbors in the world. From it is carried on an extensive trade with the Orient and, by way of the Panama Canal, with Europe and the Atlantic coast of North America; there is also a coastwise trade with Alaska and the Pacific ports of the United States.

Vancouver is the distributing center for a region rich in fruit, grain, lumber, fish, and minerals, and these resources are the basis not only of its export trade but of its manufacturing industries as well. Shipbuilding is important; other leading industries are fish canning, sugar refining, lumber milling, and the manufacture of machinery and other steel products. Stanley Park, which has an area of nearly 1,000 acres mostly in the natural state, contains a memorial dedicated to the friendship between the United States and Canada. The University of British Columbia is in Vancouver. The climate is mild and equable, and many tourists are attracted to the city. Vancouver was laid out by the Canadian Pacific Railway in 1885. Originally named Granville, the city was named after George Vancouver when it was incorporated in 1886. Population, about 345,000.



VANCOUVER ISLAND AND CITY

VANCOUVER, George (1758–1798), an explorer and discoverer. He accompanied Cook on several of his voyages, and later was in command of an expedition to explore Australia and New Zealand. From there he sailed by way of the Hawaiian Islands to North America, where, in a period of two years, he surveyed the coast from 35° to 56° north latitude. Vancouver Island (which see) was named after him. He sailed for England via Cape Horn and Saint Helena, and died shortly after his arrival at his home in Surrey.

VANCOUVER, Wash., the county seat of Clarke County, five miles north of Portland, Ore., on the Columbia River and on the Northern Pacific, the Great Northern, Union Pacific, and the Spokane, Portland & Seattle railroads. There are two airports, one a Federal field. Vancouver is the United States military headquarters for the department of Columbia. It lies in a section of large forests and farming lands. The leading industrial plants include lumber and paper mills, flour mills, an ice plant, creameries, canneries, car-repair shops, brickyards, box factories and fruit-packing plants. The state schools for the blind and the deaf and Saint Joseph's Hospital are located here. Notable buildings are a Carnegie Library, the United States National Bank Building and the courthouse and postoffice. The Interstate Bridge spans the Columbia River at this point. Vancouver was first made a post of the Hudson's Bay Company in 1824 and was incorporated as a city in 1858. Population, about 42,000.

VANCOUVER ISLAND, an island in the Pacific Ocean, off the coast of British Columbia, of which it is politically a part. It is separated from the mainland of Canada by the Gulf of Georgia and Queen Charlotte Sound, and from the United States by the Strait of Juan de Fuca. Its length is 275 miles; its greatest breadth, sixty-five miles; and its area, about 12,400 square miles. The island is generally mountainous, being a continuation of the Coast Ranges formation. It has a mild, moist climate, and in the south and east its soil is fertile and well suited to agriculture and fruit growing. The mountains are generally covered with heavy coniferous and deciduous forests. The interior is well adapted to grazing, and large numbers of horses, cattle, sheep and swine are raised. Fishing interests along the shores of the streams and lakes are of considerable importance. Mineral resources include coal, gold and copper. The coal mines are extensively worked and supply the greater part of the coal used on the Pacific coast. The chief town is Victoria, the capital of British Columbia. The island was visited by Vancouver, an officer of the British Navy, in 1792, and was named for him. The United States claimed it, but when the Oregon boundary question was settled in 1846 it became a possession of Great Britain. In 1866 it became a part of British Columbia (which see).

VAN′DALS, an ancient Teutonic people, inhabiting the region between the Vistula and the Oder, whence they moved southward and settled in Pannonia, becoming Christians of the Arian faith. At the beginning of the fifth century they entered Gaul and crossed the Pyrenees into Spain. One section settled in Galicia and were almost entirely destroyed in a struggle with the Goths and Suevi; the other settled in a part of Baetica, which received from them the name *Andalusia*. In 429 they crossed the Strait of Gibraltar, under their dreaded leader, Genseric, carrying devastation and ruin from the shores of the Atlantic to the frontiers of Cyrene. In 455 Genseric and his soldiers sacked Rome, plundering and ruining temples, beautiful buildings and works of art. The word *vandal* is still applied to the wilfully destructive.

VANDALS IN ROME

VAN′DERBILT, Cornelius (1794-1877), American capitalist and financier, born on Staten Island, N. Y. At the age of sixteen he bought a boat and ferried passengers and goods across to the city. Gradually extending his enterprise, by the age of forty he had become the owner of a fleet of steamers running to Boston and up the Hudson. In 1849 he founded a steamship and transfer line by way of Lake Nicaragua to California. Because of the large fleet of boats he owned he was popularly known as "Commodore." Later he transferred his capital from steamships to railroads, obtaining a controlling interest in a large number of Eastern roads, and extending his system to Chicago by securing the Lake Shore & Michigan Southern and Canada Southern roads. His philanthropies included a gift of a million dollars for the founding of Vanderbilt University.

VANDERBILT, Cornelius (1843–1899), son of William Henry Vanderbilt, first vice-president of the New York Central Railroad when his father succeeded to its presidency, on the death of his grandfather, Cornelius Vanderbilt, in 1877. He was a contributor to Vanderbilt and Yale universities and presented to the Metropolitan Museum, New York, Rosa Bonheur's famous painting, *Horse Fair*.

VANDERBILT, William Henry (1821–1885), son of "Commodore" Vanderbilt and his successor in the management of the Vanderbilt system of railroads, which he extended till he controlled the Michigan Central, the Lake Shore & Michigan Southern, the Canada Southern, the Chicago & North Western, the Nickel Plate and the West Shore railroads. He was considered one of the greatest authorities on transportation in his day. He gave large sums to Vanderbilt University and Columbia University.

VANDERBILT, William Kissam (1849–1920), son of William Henry Vanderbilt, was entrusted by his father with the management of numerous responsible offices connected with the New York Central Railroad and became a director in fourteen different lines. With his brothers, Frederick William and George Washington Vanderbilt, he founded the Vanderbilt Clinic in New York City, and erected Kissam Hall at Vanderbilt University, in memory of their mother.

VANDERBILT UNIVERSITY, a coeducational institution, established at Nashville. Tenn., in 1872, under the auspices of the Methodist Church. It was named in honor of Cornelius Vanderbilt, who gave $1,000,000 for establishing the school. However, the university is not now under sectarian management. There are maintained a graduate school, a college of arts and sciences and schools of law, religion, medicine, nursing and engineering. Vanderbilt University has been a strong influence in the South in keeping educational standards high. It has a student enrollment of over 1,800 and a faculty of about 400. There are nearly 243,000 volumes in the library. The university has received generous gifts from the Vanderbilt and Rockefeller families, Andrew Carnegie and the General Education Board.

VAN DYCK, or **VANDYKE**, *van dike′*, Anthony, Sir (1599–1641), next to Rubens his teacher, the most famous portrait painter of the Flemish school. He was born at Antwerp, where his father was a merchant and his mother a skilled worker in tapestry. He studied under Van Balen and Rubens and also in Genoa, Venice and Rome. Having acquired a great reputation in Antwerp as a fashionable portrait painter, he was invited to England by Charles I, who bestowed upon him knighthood and a considerable annuity. While in England he painted more than 300 portraits, his patrons including almost every distinguished person of the court. His portraits are characterized by delicacy and refinement. Those best known are *Portrait of Charles I* and *Children of Charles I,* now in Munich; and *Portrait of a Lady and Child,* in the Morgan Collection, Metropolitan Museum. Among his sacred pictures are *Elevation of the Cross* (Courtrai, Belgium), *Christ on the Cross* (Antwerp) and *Crucifixion* (Mechlin, Belgium). Van Dyck married Lady Mary Ruthven, of the English nobility, and executed several portraits of her. The best of these, showing her playing the 'cello, is in Munich. Van Dyck was also an expert in the art of portrait etching, and made his own drawings as well as the engravings. He was buried in Saint Paul's, London.

VAN DYKE, Henry (1852-1933), Amercan poet, essayist and educator. He was born at Germantown, Pa., and graduated at Princeton and at Princeton Theological Seminary. In 1878 he became pastor of the United Congregational Church of Newport, R. I., and five years later was called to the Brick Presbyterian Church of New York. Here he remained as pastor until 1900, when he became professor of English literature in Princeton University. Van Dyke wrote extensively, and always attractively, in various fields. *The Builders and Other Poems* and *Music and Other Poems* are among his volumes of poetry. *The Gospel for an Age of Doubt* and *Sermons to Young Men* are examples of his religious work; *The Blue Flower* and *The Ruling Passion* are some of his charming works of fiction, and *Fisherman's Luck* and *Little Rivers* include his best work in the field of essays. In 1913 Dr. Van Dyke was appointed minister to the Netherlands by President Wilson, a position which he held with honor throughout the greater part of the World War. This post he resigned in 1917 before the United States entered the war. After America became a belligerent he was appointed supervisory chaplain in the navy.

VAN HISE', Charles Richard (1857-1918), an American geologist and educator, born at Fulton, Wisconsin, educated in the University of Wisconsin. Soon after graduation he became connected with the faculty of his alma mater, serving successively as instructor in chemistry, assistant professor of mineralogy, professor of geology and president of the university, to which position he was elevated in 1903. Under his administration the institution became one of the most progressive and useful schools in the United States. He was particularly effective in making extension courses available to all classes of people throughout the state.

Professor Van Hise was made a member of the United States Geological Survey in 1883. He won recognition as the highest authority on rocks of the Algonkian and Archaean Systems and especially on the ore-bearing rocks of the Lake Superior region. He was the author of a series of books on geological subjects and of *The Conservation of Natural Resources in the United States.*

VAN HORNE, William Cornelius, Sir (1843-1915), railway official and expert, best known for his connection with the Canadian Pacific Railway, which was completed under his energetic and efficient management. He served that railway from 1882 to 1910 as general manager, vice-president, president and chairman of the board of directors, successively. Van Horne was born in the United States and served several mid-western railroads in that country before being called to Canada.

VANIL'LA, a genus of plants belonging to the orchid family, source of the well-known vanilla of commerce. The plants are common in Mexico, and are also found in Central and South America and the East Indies. The vanilla plant climbs by means of aerial roots and has large white, red or greenish flowers. The fruit is a long, brown, shiny bean, filled with a dark, oily, odorous pulp. This bean is gathered before it is fully ripe, and the oil is extracted by a slow process which brings out its peculiar odor and flavor. Vanilla is used in medicine as a

VANILLA

stimulant, but its chief use is in the preparation of liquors and perfumery and in flavoring candy and other confections. The vanilla plant is propagated by cuttings, produces a crop every three years and continues bearing for thirty or forty years. Vanilla is produced artificially by several methods; the artificial product is very common. A substitute is made from the tonka bean.

VAN LOON, Hendrik Willem (1882–1944). Born in Rotterdam, Holland, and educated in Universities in Europe and America, he became a reporter, editor, professor of history, then one of the most notable authors of his generation. Van Loon came to public attention when he published *The Story of Mankind;* he wrote it in 1921 solely for his son, but was induced to publish it. Another volume, *Van Loon's Geography,* proved equally popular. *The Story of the Bible, Ancient Man, America, The Fall of the Dutch Republic, The Rise of the Dutch Kingdom, A Short History of Discovery, Tolerance, Ships and How They Sailed the Seven Seas, Air-Storming, Lives,* and *Invasion* followed. He illustrated his works with his own pen-drawings.

VA'POR, in physics, the gaseous state into which solids and liquids pass when heated. In their structure and physical properties, there is practically no difference between vapors and gases (see Gas), but in ordinary usage the term *vapor* is applied to those gases that are formed by the action of heat on liquids and solids, while the term *gas* is applied to those substances which remain in gaseous form under ordinary conditions of temperature and pressure. We speak of steam as a vapor and of oxygen as a gas. Water vapor formed by the action of the heat of the sun on the surface of the land is always present in the atmosphere and has an important effect on climate. See Rain.

VARICOSE, *var e kose',* **VEINS,** dilated veins, which are marked by knotty swellings at the valves. The disease commonly affects the lower limbs and sometimes becomes very painful and even dangerous, from the bursting of the veins, though it often is merely an inconvenience. Rest and support in an elevated position and the application of proper bandages are elements in the treatment of this condition.

VARI'ETY, in plant and animal classification, a subdivision of a species, including an individual or group of individuals differing in some nonessential way from the rest of the species. Varieties are believed to result from differences in climate, nourishment, cultivation and the like, and to be less permanent than species.

In naming plants and animals, the name of the variety is placed third, following the name of the species; as *Ranunculus multifidus,* variety, *terrestris.* Here, *Ranunculus multifidus* is the common, yellow, water crowfoot, and the variety *terrestris* is a form growing on the ground.

VA'RIOLOID, a mild form of smallpox, induced by inoculation. See Smallpox.

VAR'NISH, a transparent liquid made by dissolving gums in alcohol, turpentine or oil. It is used to form a transparent coat over surfaces to protect them from air and moisture or to make them more beautiful. The resinous substances most commonly employed for varnishes are mastic, lac, copal, amber, and asphalt; and the solvents are fixed oil, volatile oil, and alcohol. Varnishes are colored with arnotto, gamboge, saffron, dragon's blood, and other substances.

The base of varnish is gum copal, or the fossil gum found in Zanzibar, Sierra Leone, New Zealand and the Philippine Islands. The best gum is found in Zanzibar. When the gum is received in the varnish factory, it is broken up into pieces about the size of small egg coal. As it is being broken up, it is selected, for in one chunk of the amberlike material there may be both transparent and almost opaque streaks; the white transparent gum goes into the making of the best grades of varnish, and the dark-colored gum goes into the poorer grades. After the gum copal is broken, it is run through a series of hand sieves, which divide it into block, nut, chip, and dust, for convenience in handling. The gum is then ready for the kettle.

For first-class varnish, Calcutta linseed oil is preferred. This oil is made from the flaxseed of India. The turpentine used for thinning the varnish is of the best and purest grade. The copper kettles in which the melting and mixing are done are on truck wheels, so that they can be rolled over a fire or taken off easily. The melting gum is constantly stirred. When the oil has been mixed with the liquid gum, the kettle is run back over the fire once more, and the gum and oil are boiled again. Then it is set away to cool, after which a quantity of turpentine is mixed with the gum and oil and the varnish is made. The varnish is strained through cotton before it is pumped into the storage tanks, where it is left to age for at least six months and often for two years.

Shellac varnish is made in churns, or barrels, revolving on journals. The shellac as it comes from India looks like amber-colored mica, for it is in thin sheets and is almost transparent. This shellac is mixed with the proper amount of alcohol, to dissolve it and form the varnish.

VAS′CO DA GAM′A. See GAMA, VASCO DA.

VASE, a vessel of an ornamental character, generally of pottery but frequently of stone, glass, metal or other materials. Those which have come down to us from ancient times in greatest numbers are the so-called Etruscan vases, made of terra cotta and adorned with painted figures (see ETRURIA, subhead *Etruscan Vases*). The Greek vases of the oldest style come chiefly from Corinth and the islands of Thera and Melos. Those of the late rich style have been almost exclusively discovered in Lower Italy, Apulia and Lucania. They were probably manufactured there, chiefly in the fourth and third centuries B. C.

Italy, France and Germany in the sixteenth and seventeenth centuries produced many vases which are the perfection of artistic form and execution, and since the fifteenth century the Venetian vases have been masterpieces of art. From India, China and Japan also have been obtained vases of various materials, especially of porcelain, which are distinguished for their elegance of form and beauty of ornamentation. Vases have been produced in the potteries of the United States which compare favorably with those made in other lands.

VASELINE, *vas′e lin,* or *vas′e leen,* a registered trade-mark used on products of the Chesebrough Manufacturing Company, Consolidated. The chief product is petroleum jelly, a semisolid mixture of hydrocarbons, distilled from petroleum and purified. It is used largely as an unguent and lubricant. See PETROLEUM.

VAS′SAR COLLEGE, one of the leading American colleges for women, founded near Poughkeepsie, N. Y., in 1861, and named in honor of Matthew Vassar, whose generosity made its establishment possible. Besides residence houses, students' building, chapel, library, observatory and classroom building, there are separate buildings for music, art, chemistry, physics, social sciences and physical education; a new infirmary building was completed in 1940. The campus and farm, on which is maintained a model dairy, include 900 acres. Flower gardens, an open-air theater and athletic grounds are other interesting features. Vassar maintains high standards of scholarship and provides courses leading to the degrees of bachelor of arts and master of arts. There is a faculty of nearly 200, and a student enrollment of about 1,200. The library contains over 225,000 volumes.

Matthew Vassar (1792–1868), founder of the college, was born at Norfolk, England, but was brought to America when four years old. His boyhood was passed near Poughkeepsie, where his father built up a prosperous brewing business. Besides contributing funds to establish the college which bears his name, he gave generously to other causes.

VATICAN CITY, the smallest independent state in the world, the domain of the Pope. It is also the center of the Roman Catholic religion; therefore the Pope is a temporal ruler as well as the spiritual head of his Church. Before 1870 the Papal States, about 16,000 square miles in Northern Italy, were controlled by the Church, and in them the Pope exercised temporal power. When modern Italy was organized, the Papal States were seized; the Pope was given the Vatican Palace and the Lateran palaces in Rome, in which he secluded himself a voluntary prisoner, and from which his successors never ventured.

Continued protest against loss of temporal power led to an agreement in 1929 by which 108.7 acres within Rome were ceded to the Church, an area once more assigned to the temporal power of the Pope. In addition, 750,000,000 lire in cash and 1,000,000,000 lire in Italian bonds were given to the Pope as added recompense for the loss of the old Papal States. The civil rule of the Pope embraces all legal, executive and judicial powers, but he entrusts his authority to a governor, who is responsible solely to him. Vatican City possesses its own postal system and coinage. Population, about 1,000. See PAPAL STATES; POPE.

Vatican Palace, the residence of the Pope, the chief building in Vatican City, no less famed than St. Peter's Church. Its construction was begun about 1150; it has been many times enlarged, and is said to contain 1,100 rooms. On the walls and ceilings are renowned works of art by Michelangelo, Raphael, and others. The library contains priceless collections of manuscripts and rare books, many of them hundreds of years old. The total number of volumes is not less than 250,000.

VATICAN COUNCIL, the Ecumenical Council of the Church of Rome, which met in the Vatican under Pope Pius IX, Dec. 8, 1869, and adjourned July 18, 1870. No council had ever been attended by so large a number of ecclesiastics. It declared the personal infallibility of the Pope, when speaking *ex cathedra,* to be a doctrine of the Church, a declaration yet maintained.

VAUDEVILLE, *vode'vil,* in the French sense, a kind of farcical comedy in which dialogue is interspersed with dancing, comic acting and songs of the day, a name originally given to a popular humorous drinking song, first composed in the valley of *Vau-de-Vire.* In the United States, vaudeville is merely a series of singing, acting and dancing numbers, pretending to no unity and having no relation to the drama.

VAULT, in architecture, a continued arch, or an arched roof, so constructed that the stones, bricks or other materials of which it is composed, sustain and keep one another in place. Vaults may be cylindrical, elliptical, single, double, cross, diagonal or Gothic.

VEDAS, *va'das,* from a Sanskrit word meaning *know,* the oldest sacred writings of India, written in Sanskrit and supposed to have been produced by a series of authors between 1500 and 1000 B. C. The Vedas are four in number, called respectively, the *Rig-Veda, Yajur-Veda, Sama-Veda* and *Atharva-Veda.* Of these the *Rig-Veda* is the oldest and most important. Its name means *stanzas of praise,* and it consists of more than a thousand hymns, most of them celebrating the deeds and begging the blessing of the greater gods. The other three seem to have been drawn largely from the first one. The latest of the four is sometimes questioned as to authenticity, being concerned rather with superstition than with religion. It reflects the development of the Brahmanical system with its departure from the earlier monotheistic system and its polytheistic rites.

All the Vedas are believed by the Brahmans to be inspired, and are held by them in the highest respect.

VEGA CARPIO, *va'ga kahr'pe o,* FELIX LOPE DE (1562–1635), a dramatic poet of Spain, best known as Lope de Vega, the most prolific imaginative writer in the annals of literature. Born in Madrid, in 1562, he joined the army, and in 1588 accompanied the Invincible Armada on its ill-fated expedition against England. After being twice married and twice a widower, he became a priest and subsequently entered the order of Saint Francis. He had already published various poems, but his dramatic and poetical productions now multiplied with extraordinary rapidity. For many years there was scarcely a week when he did not produce a play, and he himself declared that he often wrote, rehearsed and produced a play in twenty-four hours. He enjoyed an immense popularity and received marks of distinction from the king of Spain and from Pope Urban VIII. About three hundred of his dramatic works have been printed. They reveal an inexhaustible, though ill-regulated, imagination, a strong mixture of the sublime and the ridiculous and extraordinary facility in versification.

VEGETABLE, *vej'e ta b'l,* **I'VORY.** See IVORY PALM.

VEGETABLES, in the sense in which the term is generally used, those parts of plants, exclusive of fruits, which are used for food. In some, as the turnip, the roots are the parts used; in others, as the onion, the bulbs. The tubers of the potato and artichoke; the stems of asparagus; the leaves of the lettuce and cabbage; the flower buds of the cauliflower; the green fruit of the cucumber; the ripe fruit of the tomato; the seeds of corn, peas and beans, are common vegetable foods.

The principal components of vegetables are water, protein, fat, nitrogen, starch and certain indigestible refuse, like fiber and ash. The proportions of these constituents vary among different vegetables, but in all, the principal element is water. The amount of water varies from 58.9 per cent, in green beans, to 95.4 per cent, in the cucumber. The per cent of protein varies from .4 per cent, in the watermelon, to 9.4 per cent, in green beans. The amount of fat varies from .1 per cent, in the pumpkin, the radish, the potato, celery and the beet, to 1.1 per cent in green corn. The energy values of vegetables and other food plants are measured by calories (see CALORIE). Among the vegetables having high energy value are lima beans, corn, green peas, and sweet potatoes (see accompanying chart). In addition to their nutritive value, vegetables contain vitamins and minerals essential to health. See also COOKERY (Table III); DIET; NUTRITION; VITAMINS.

Related Articles. For descriptions of vegetables in general use, consult the following titles:

Artichoke
Asparagus
Bean
Beet
Brussels Sprouts
Cabbage
Carrot
Cauliflower
Celery
Chard
Corn
Cress
Cucumber
Eggplant
Garlic
Kale
Kohlrabi
Lentil
Lettuce
Onion
Parsley
Parsnip
Pea
Potato
Pumpkin
Radish
Rhubarb
Rutabaga
Salsify
Spinach
Squash
Sweet Potato
Tomato
Turnip
Yam

VEIN, *vane*, in geology, a crack in rock filled with mineral matter deposited by water. Veins are the most important source of gold, silver, copper, tin, and many other ores. They range from barely visible streaks to thicknesses of several feet. Many were formed by rain water that dissolved minerals and carried them into rock crevices. Others were made by hot water that brought up material from igneous rocks deep underground.

VEIN, a tube or vessel that carries blood back to the heart after it has been carried from the heart to the body cells by arteries. The blood flowing into the heart is a dark bluish red because it has taken in waste carbon dioxide and has little oxygen. (See BLOOD, *How the Blood Circulates.*) Veins, like arteries, have three coats — an inner, a middle, and an outer. The walls of veins are not nearly so thick as those of arteries, and they collapse readily when cut. In a vein the blood does not pulsate as in an artery. The pressure in a vein is a great deal lower because it flows evenly. Veins also differ from arteries in having valves. These are tiny flaps made of folds in the inner coat. The valves lie against the wall when the blood flows freely, but when the flow is obstructed the valves are forced upward until they meet in the middle of the vein, thus keeping the

FOOD VALUES OF SOME FRESH VEGETABLES — Servings of about 3½ oz. (100 grams)

Vegetables	**Food Energy** *Calories*	**Protein** *grams*	**Calcium** *milli-grams*	**Phosphorus** *milli-grams*	**Iron** *milli-grams*	**Vitamin A** *Intl. units*	**Vitamin B** *milli-grams*	**Vitamin C** *milli-grams*
Asparagus	26	2.2	21	62	.9	1,000	1.53	33
Beans, lima	131	7.5	63	158	2.3	280	1.29	32
Beans, snap	42	2.4	65	44	1.1	630	.78	19
Beet greens	33	2.0	*118	45	3.2	6,700	.52	34
Beets	46	1.6	27	43	1.0	20	.48	10
Broccoli	37	3.3	130	76	1.3	3,500	1.20	118
Brussels sprouts	58	4.4	34	78	1.3	400	.47	94
Cabbage	29	1.4	46	31	.5	80	.43	52
Carrots	45	1.2	39	37	.8	12,000	.63	6
Cauliflower	31	2.4	22	72	1.1	90	.81	69
Celery	22	1.3	50	40	.5	0	.37	7
Chard	25	1.4	*105	36	4.0	2,800	.39	38
Corn	108	3.7	9	120	.5	390	1.69	12
Cucumbers	14	.7	10	21	.3	0	.33	8
Eggplant	28	1.1	15	37	.4	30	.93	5
Kale	50	3.9	225	62	2.2	7,540	1.27	115
Lettuce, head	18	1.2	22	25	.5	540	.33	8
Lettuce, other	18	1.2	62	20	1.1	1,620	.33	18
Okra	39	1.8	82	62	.7	740	.92	30
Onions, mature	49	1.4	32	44	.5	50	.15	9
Parsnips	83	1.5	57	80	.7	0	.40	18
Peas, green	101	6.7	22	122	1.9	680	2.64	26
Peppers, green	29	1.2	11	25	.4	630	.51	120
Potatoes	85	2.0	11	56	.7	20	1.17	17
Pumpkin	36	1.2	21	44	.8	3,400	.73	8
Radishes	22	1.2	37	31	1.0	30	.18	24
Rutabagas	41	1.1	55	41	.4	330	.62	36
Spinach	25	2.3	*81	55	3.0	9,420	1.06	59
Squash, summer	19	.6	15	15	.4	260	1.19	17
Squash, winter	44	1.5	19	28	.6	4,950	.73	8
Sweet potatoes	125	1.8	30	49	.7	7,700	.86	22
Tomatoes	23	1.0	11	27	.6	1,100	.70	23
Turnip greens	37	2.9	259	50	2.4	9,540	1.46	136
Turnips	35	1.1	40	34	.5	Trace	.62	28

*May not be available because of presence of oxalic acid.

blood from flowing backward. The action of the valves may be shown by pressing on some vein near the surface, thus preventing the flow of the blood toward the heart, when the valves will make little elevations in the vein. Valves are not found in the very smallest veins, nor in those of the abdomen, lungs and brain.

The blood flowing from a wounded vein is dark in color and comes out in an even stream. To check the flow, press on the vein below the wound or between it and the extremity.

Related Articles. Consult the following titles for additional information:

Arteries	Circulation
Capillaries	Wound

VELAZQUEZ, or VELASQUEZ, *va lahs'kaith,* DIEGO RODRIGUEZ DE SILVA Y (1599–1660), the most famous master of Spanish painting. He was born at Seville, of Portuguese parents, and studied first under Francisco Herrera the Elder and afterward under Francisco Pacheco. Velazquez was fortunate in having so admirable a teacher as Pacheco at a formative period in his career. Less talented than his pupil, Pacheco had a remarkable gift for imparting basic principles concretely, and from him Velazquez gained a thorough knowledge of proportion, perspective, color, and light and shade. In 1622 he went to Madrid, and as the result of this visit received an appointment as principal painter to Philip IV. Through the advice and intercession of Rubens, Velazquez went later to Italy, where he closely studied the works of Michelangelo, Raphael, and Titian and the contemporary painters, especially Guido Reni, whose influence is evident to a marked degree in his works. On his return to Spain, in 1631, Velazquez was received with great distinction, and in 1658 the king raised him to the dignity of a noble.

Velazquez' chief characteristic in painting is naturalism. He was never imaginative, but painted exactly what he saw, combining this power of realism with a mastery of light, shade, coloring, and composition. Among his finest works are the *Aguador,* or *Water Carrier;* a *Nativity,* or *Adoration of the Shepherds;* the *Brothers of Joseph; Moses Taken from the Nile; The Surrender of Breda;* portraits of Philip IV and of Elizabeth, his queen, Pope Innocent X and other dignitaries, and many pictures from common life.

VELOCIPEDE, *ve los'e peed,* a light vehicle or carriage propelled by the feet of its rider. One of the older forms of this carriage was constructed of two wheels of nearly equal size, placed one before the other and connected by a beam, on which the driver's seat was fixed. The rider, sitting astride the machine, propelled it by the thrust of each foot on the ground. This form dates from the early part of the nineteenth century. It was about half a century later that treadles, operating cranks on the axle of the front wheel, came into use. See BICYCLE.

VELOCITY, *ve los'e ty,* the rate at which a body changes its position in space. Velocity is popularly expressed as so many miles per hour or as so many feet per second. The velocity of a body is *uniform,* when it passes through equal spaces in equal times; it is *variable,* when the spaces passed through in equal times are unequal; it is *accelerated,* when during each portion of time it passes through a greater space than during the preceding equal portion; it is *retarded,* when a less space is passed through in each successive portion of time. Linear velocity is speed forward in a straight line; angular velocity is speed about an axis.

VEL'VET, the most familiar of the fabrics woven with a pile, produced by adding to the usual threads of the warp and weft an additional row of warp yarns, woven into the ground of the cloth and passed over wires on the surface. In the case of a loop pile, the wires are drawn out, without cutting, but for velvet or other cut pile, a knife is passed along a groove on the top of each wire before the wire is withdrawn. Real velvet is made entirely of silk. Cotton and woolen goods, woven in this manner, are called *velveteen* and *plush,* respectively.

Some of the richest and most artistic of the textiles woven on Italian looms in the fifteenth and sixteenth centuries were made, in part at least, of velvet. Similar stuffs were also made in Spain and Flanders. Many of these were for ecclesiastical vestments and altar cloths, and for hangings. The effect of a raised pattern in velvet, on a plain or figured silk ground, is very beautiful. Sometimes a design is formed of a long, upon a short, pile, called *velvet upon velvet,* and this, too, has a fine effect. Velvet is believed to have been made first in China.

VELVET LEAF. See INDIAN MALLOW.

VENATION, *ve na'shun,* the arrangement of veins in leaves, related to the shape of the leaf and its mode of germination, an important characteristic in the classification of plants. Most leaves are netted-veined, parallel-veined or fork-veined. The netted-veined are the most numerous, and are divided into several groups. True netted leaves have a single midrib from which branch primary veins terminating in delicate veinlets that curve upward just within the margin of the leaf. If the primary veins extend directly to the edge of the leaf they are said to be feather-veined. For illustrations of venation, see the article LEAVES.

VENDET'TA, an Italian word taken from the Latin *vindicta,* meaning *revenge.* It is applied to a blood feud in which the next of kin assumes responsibility for avenging a murdered person, probably a survival of methods of enforcing justice practiced before the organization of public courts. In Corsica the vendetta was held to be one of the most binding of family obligations, and the custom is held to a greater or less degree among the Albanians, Druses, Bedouins and other isolated and primitive peoples. The *feuds* among the mountaineers of Eastern Kentucky and Tennessee and western Virginia in America are analogous to the vendetta. See BLOOD, AVENGER OF.

VENDOME, *vahN'dohm',* **COLUMN,** 142 feet high, stands in Paris, in the Place de la Vendôme. It was built in 1806-1810 at Napoleon's order, to commemorate his 1805 victories in Russia. The column was later thrown down by the communists, but the preserved pieces were re-erected on the same spot in 1875. The masonry column is set with 900 feet of bronze, made from 1,200 melted captured cannon, depicting memorable scenes in the Napoleonic campaigns. The Place de la Vendôme was named for the Duke of Vendôme, who as a member of a noble house of the old French kingdom served his country in many wars.

VENEER', a thin layer of hard wood, as mahogany, rosewood or maple, glued to the surface of other woods to enhance the appearance of furniture and some interior finishings. Owing to recent improvements in sawing machinery, layers can be obtained that are almost as thin as paper. A good piece of veneer, contrary to popular belief, may be more serviceable than solid wood, for the reason that it is less likely to warp.

VENETIAN, *ve ne'shan,* **SCHOOL OF PAINTING.** See TINTORETTO; TITIAN; VERONESE, PAUL.

VENEZUELA, *ven e zwe'la,* a republic of South America, officially known as the Republic of Venezuela. It is the most northerly country of the South American continent, and its much-indented coast line borders on the Caribbean Sea for about 1,750 miles. British Guiana lies to the east of Venezuela, Brazil is on the southeast, and Colombia is west and southwest. In Caribbean waters offshore are more than seventy islands belonging to Venezuela. The largest are Margarita (400 square miles) and Tortuga (85 square miles). In 1942, Great Britain ceded to Venezuela the island of Patos, three miles off the coast. It is 170 acres in area. The area of Venezuela is given officially as 352,143 square miles. The country is a union of twenty states, two territories, a Federal Dependency and the Federal District, which contains the capital and largest city, Caracas.

The People. The population of Venezuela numbers over 5,000,000. About 65 per cent of the people are mestizos of mixed white and Indian descent. Whites make up about 20 per cent of the total population. They are for the most part Spanish in background. The rest of the population is composed of Negroes and Indians.

Venezuela is a Roman Catholic country, but religious tolerance prevails. In the elementary schools religious instruction is given only to children whose parents request it.

Public education is under the control of the Federal government. Attendance is free in elementary schools, and is compulsory for children between the age of seven and completion of the secondary schools. A mass program of adult education introduced after World War II greatly reduced illiteracy.

Completion of the six-year elementary course is required for entrance to the secondary schools. The National Pedagogical Institute in Caracas, founded in 1936, offers a three-year course for elementary teachers and two-year advanced courses for teachers preparing for high-school service. Universities have been established in Caracas, Merida and Maracaibo; they were granted autonomy in 1946. In Caracas there are special schools of agriculture, commerce and modern languages, as well as technological institutes. Museums, libraries and academies of learning are maintained at government expense in different cities.

Surface and Drainage. Venezuela is

naturally divided into four surface regions—the Guayana Highlands, the central plains, or *llanos,* the mountain areas of the north and west and the Maracaibo lowlands.

The Guayana Highlands, comprising the state of Bolivar and the territory of Amazonas, occupy the southern half of the country. This area is an elevated plateau of dense forests and is largely unexplored. It rises from the right bank of the Orinoco River to the border ranges of the Parima and Pacaraima mountains, its highest points being Mount Maraguaca (10,500 feet) and Roraima Peak (8,661 feet). The latter is near the point where the borders of Brazil, Venezuela and British Guiana meet.

The central plains are a tract of level grasslands containing the principal grazing areas of Venezuela. They extend for 700 miles between the Colombia boundary and the Carribean Sea, and lie chiefly north of the Orinoco.

The greater part of Venezuela's population is found in the mountain district of the north and west, as this region contains fertile valleys and is near the sea. Farther west is the Sierra Nevada de Merida, a range of the Andes which enters the country from Colombia and divides into two parallel ranges. Extending eastward along the coast are two parallel ranges known as the Maritime Andes, or Caribbean Hills. In the valley of this chain the capital city of Caracas is situated. The highest peaks of Venezuela are found in the Sierra Nevada de Merida. This range reaches an altitude of 16,410 feet in La Columna, and has numerous other peaks over 15,000 feet high, eternally crowned with snow.

The fourth region, comprising the Maracaibo lowlands, lies in the northwest corner of Venezuela. Its principal feature is Lake Maracaibo, which has direct connection with the sea by a strait nearly nine miles wide. Many rivers traverse the lowland region, which contains rich deposits of oil.

About four fifths of Venezuela is drained by the Orinoco River and its 436 tributaries. This great river system is the third largest in South America (see ORINOCO).

Climate. Venezuela lies wholly within the torrid zone, but it has three climatic zones, based principally on differences in altitude. The hottest zone, with temperatures ranging from 75° to 97° F., comprises territory less than 1,800 feet above sea level. The central plains and coastal areas make up the greater part of this zone, in which are situated the cities of Maracaibo and La Guaira, the port of Caracas. The second (temperate) zone includes the regions that are from 1,800 to 6,000 feet in altitude. Temperatures range between 50° and 77° F. The chief city in this zone is Caracas, situated at an altitude of about 3,000 feet. The third zone takes in all territory above 6,000 feet. Temperatures in the lower cities in this zone go as low as 14° F., and on the mountain peaks Arctic cold prevails.

Venezuela, like other tropical countries, has only two seasons—the wet and the dry. The former, lasting from May through November, is a period of torrential rains. Parts of the lowlands and interior plains experience flood conditions during this season, and the days are hot and humid. From December through April the weather is fairly pleasant, and the heat is tempered by dry, refreshing winds from the north.

Mineral Resources. Venezuela is rich in minerals, but a lack of transportation facilities and of modern machinery, and a scarcity of capital have delayed the exploitation of many of these resources. An exception is petroleum, which is found abundantly in the Lake Maracaibo district and in the eastern part of the country. Foreign companies have been granted rights to exploit the wells, with the proviso that a considerable number of native laborers must be hired. Profits from the oil wells give Venezuela a higher per capita income than any other South American country. Venezuela usually ranks third in world production, being surpassed by the United States and the Soviet Union. Most of the crude oil is refined on the Dutch islands of Aruba and Curaçao.

Venezuela also has one of the world's most important sources of asphalt in Bermudez Lake, 1,000 acres in extent. It is located in the northeastern part of the country. Enormous deposits of high-grade iron ore are mined in the area along the Caroní River. Ore from Cerro Bolivar, a mountain rich in iron, is exported from Puerto Ordaz. Other resources being developed include gold, magnesite, asbestos, and mica. Salt mines are worked by the government. There are pearl fisheries off Margarita Island.

Agriculture. About one fifth of the population is engaged in agriculture, comprising three fourths of all persons gainfully employed. Coffee, the most important product, is grown generally over the country but flourishes best in the higher altitudes of the states of Tachira, Merida and Trujillo. Cacao, for the production of cocoa, is second to coffee in value. Both products are exported and both are of excellent quality. Sugar, corn, cotton, wheat, rice, oats, tobacco, bananas and truck crops are raised for home consumption, and the country also produces a variety of tropical products, including copaiba, caoutchouc, tonka beans and vanilla. Venezuela's forest wealth is yet to be developed. Its grazing lands support large herds of cattle. Other livestock includes sheep, goats, horses, mules and hogs.

Industry and Commerce. Because of a lack of raw materials, Venezuela has few manufacturing industries. The most important is wood-working. Cotton mills in several cities produce calico, denim, knit goods and hosiery. Products of less importance include carbonated beverages, straw hats, glass, cement, cordage and candles. Closely related to agriculture are tanneries using native skins, meat-packing plants, creameries and dairies, sugar mills and tobacco factories.

Venezuela has several good natural harbors, as well as a man-made port at La Guaira, gateway to Caracas. Other active ports are Maracaibo, Puerto Cabello, Cristobal Colon and Ciudad Bolivar. In peacetime, Venezuela's most important foreign customers are the United States, the United Kingdom, Germany, the Netherlands, Canada and France. Petroleum, coffee and cacao are the leading exports. There is a thriving coastal trade.

Transportation. Inland transportation routes include about 12,000 miles of navigable rivers and channels, about 700 miles of commercial railways, and about 4,000 miles of roadways for year-round use. There are eleven main lines of railway, of which two are British owned. The Great Railway of Venezuela, 112 miles in extent, connects Valencia and Caracas. The twenty-three-mile La Guaira-Caracas Railway, extending from the capital to the sea, is the country's most scenic railroad. The Venezuelan portion of the Pan-American Highway was opened in 1943. Some of the newer motor roads traverse the lofty Andean ranges. The country is also served by airlines.

Government. The Republic of Venezuela is headed by a President who is elected by popular vote for a five-year term. Two Senators are elected from each state and remain in office four years. Members of the Chamber of Deputies also serve four years, but are chosen according to population. Territories may send Deputies to Congress if the population is large enough. Men and women between the ages of 21 and 65 are required to vote. People who cannot read or write use colored ballots. The vote is secret. The Supreme Court is composed of seven members, chosen by Congress for a limited term. The President has the right to ask the Court to give judgment on an act which he considers unconstitutional. Political unrest in Venezuela has caused many constitutional changes. Its constitution recognizes the individual's right to private property, education, employment, and health. Monopolies are illegal in Venezuela. Labor has the right to organize and to strike, and workers are guaranteed pensions and vacations with pay. Each of the states of Venezuela has a legislative assembly and a governor.

History. The coast of Venezuela was first seen by Columbus in 1498. The following year an expedition including Americus Vespucius gave the region the name it now bears, which means *Little Venice;* it was applied because of the discovery of Indian villages built on piles along the swampy shores of Lake Maracaibo. The first permanent white settlement in South America was founded by the Spanish in 1522, on the site of Cumana. Venezuela was under Spanish rule until 1821, when it was united with Colombia. In 1829 it became independent.

In spite of social uprisings and boundary disputes, Venezuela has made great progress toward political stability. A dispute with Great Britain over the boundary between Venezuela and British Guiana (1895) was settled by arbitration after President Cleveland had intervened. In 1903, President Theodore Roosevelt protested a blockade of Venezuelan ports by Italy, Great Britain and Germany and the difficulty was referred to The Hague. Under the dictatorship of General Juan Vicente Gomez, the country paid off its foreign debts.

Venezuela maintained a state of neutrality in World War I; in 1920 it joined the League of Nations. In World War II it supported the United States in its program for Western Hemisphere defense and broke off diplomatic relations with the Axis after the Japanese attack on Pearl Harbor. It is an original member of the United Nations.

Related Articles. Consult the following titles for additional information:

Bolivar, Simon
Caracas
Maracaibo
Maracaibo, Lake

VENICE, *ven'is,* ITALY (in Italian, Venezia), a city famed for its unique character and splendid art treasures. Venice, built on a cluster of islands, has canals for its principal streets, and more bridges than any other city in the world. Gondolas and other boats take the place of cabs, street cars and automobiles. The city lies in a sheltered lagoon on the northwestern shore of the Adriatic Sea, 164 miles by rail east of Milan. The islands on which it is built number 120, and are divided into two main groups, between which flows the celebrated Grand Canal. This canal, which is the principal thoroughfare, passes through the city in the form of a letter *S* and divides it into two nearly equal parts. The canal is crossed by four bridges, the chief of which is the Rialto. There are 146 smaller canals, by means of which all parts of the city can be reached.

In amount of ship tonnage entering its harbor, Venice is normally the fourth Italian seaport. A new port on the mainland, called Marghera, was built by Mussolini, when he was the Italian dictator. A long sandbank, the Lido, separates the island waters from the Adriatic, and is a fashionable beach resort. It is protected by a sea wall.

The Piazza, or Square of Saint Mark's, is the center of interest. This is the great center of business and amusement. It is 576 feet long, 269 feet wide on one side and 185 feet wide on the other. The east side is faced by the Cathedral of Saint Mark's, one of the most renowned structures of its kind in the world. On the north and south sides of the square are the palaces formerly occupied by the procurators of the cathedral, and they now form a part of the royal palace. These buildings contain many rare paintings by some of the most celebrated artists of Venice, including Tintoretto and Paul Veronese. The famous Campanile, which fell in 1902 and was rebuilt, also faces the square. Another object of interest facing the square is the clock tower, built in 1496 and surmounted by two bronze figures which strike the hours on a large bell.

Among the churches of special interest is that of Santa Maria della Salute, which contains excellent paintings by Titian, including his masterpiece, *The Assumption of the Virgin,* and *The Presentation in the Temple.*

The Church of San Sebastiano is celebrated for its altarpieces by Paul Veronese, and the Friari, a church built for the friars, is interesting for its size and because it is a good representation of the Italian Gothic style of architecture. The palaces are of no less interest than the churches. Of these the palace of the Doges, originally built in 800 but several times destroyed and rebuilt, is the most important. During the time of Venice's greatest prosperity, this was the residence of its rulers. It now contains many treasures of art. From the rear of this palace the celebrated "Bridge of Sighs" leads to the prison, which is still in use. Many of the palaces are now used for other purposes, serving as hotels, museums and office buildings. The Academy of Fine Arts is also of great interest, because it contains one of the most valuable collections of paintings found in Europe. The Rialto is the principal commercial street. The bridge of this name crosses the Grand Canal at the point where the first settlement was made.

Modern Venice is of considerable commercial importance. The manufactures include lace, tapestries, mosaics, bronzes, jewelry and wood-carvings among its finer wares, and cotton and woolen goods, chemicals, heavy machinery and clocks among its larger industries. There is also some shipbuilding.

The islands occupied by the city were formerly a refuge from the hordes of barbarians which invaded Italy from the north. It is supposed that the first settlement was made about the middle of the fifth century, but there is no authentic record of the fact. In the sixth century Venice was independent, though it was tributary to the Eastern Empire. It was obliged to defend itself from pirates and from the Lombards of Italy, and because of this an organized government was formed and the leader or ruler, entitled *doge,* was selected. The Crusades gave the city a great impetus, because it became a commercial center for military movements.

During the Middle Ages Venice increased in commercial importance and power until considerable surrounding territory of the mainland was under its control. Genoa was long a close rival, but was defeated by Venice in 1380, after long fighting. Just previous to the discovery of America Venice was the leading commercial city of Europe, but from that time its influence began to wane. The Turks captured Constantinople in 1453 and cut off much of the trade from the East. A route to India around the Cape of Good Hope also brought much of that trade to Portugal, and the commerce which had entered Europe through Venetian harbors now came through Genoa and other cities to the west. In 1797 the Venetian Republic was deprived of its independence by Napoleon, and most of the possessions were given to Austria. Within a few years the Austrians ceded Venice to Italy. Between this time and 1866, the city was alternately under the rule of Austria and Italy, until finally by vote of the inhabitants it was joined to Italy.

The proximity of Venice to the war zone during the First World War caused great anxiety as to its fate, but the city was never captured. From the close of World War I until the outbreak of war in 1939, Venice was once more the mecca of art lovers and tourists. The city was occupied by the Germans during the Second World War; it was liberated by Allied forces in 1945. The population is about 302,500.

Related Articles. Consult the following titles for additional information:

Adriatic Sea
Bridge of Sighs
Campanile
Doge
Polo, Marco
Saint Mark's, Cathedral of

VENIZELOS, *ven e za' lohs,* ELEUTHERIOS (1864–1936), an eminent Greek lawyer and statesman, through whose influence Greece was brought into World War I on the side of the Entente Allies, was born of humble parentage on the island of Crete. He was educated in Canea, Crete, and the University of Athens. After completing his education Venizelos returned to Crete, and at the age of twenty-three was elected to the assembly, where he soon became the leader of the liberal party. In 1910 he removed to Athens to become the leader of a party founded by the Military League, which was working for constitutional reform. Within a year he was chosen Prime Minister.

In 1913 King Constantine, whose wife was a sister of Emperor William II, ascended the throne of Greece. At the outbreak of the First World War, Venizelos led the movement to unite Greece with the Entente Allies, but Constantine advocated strict neutrality. Venizelos resigned in March, 1915, since he and the king could not work together. He was, however, persuaded to form a new Ministry; when Bulgaria entered the war against Serbia, he insisted that the Greek forces be mobilized, and accomplished his purpose in spite of the king's opposition. Since Greece was bound by treaty to go to the aid of Serbia if it were attacked by Bulgaria, Venizelos insisted that this agreement be fulfilled. Constantine refused his consent, and the Prime Minister again resigned.

In September, 1916, Venizelos and his followers set up a provisional government at Canea, but later transferred it to Saloniki. When Constantine was forced to abdicate in 1917, Venizelos was returned to power and Greece joined the forces against the Central Powers. He represented his country at the peace conference at Versailles in 1919. In 1935 Venizelos inspired a revolution against the government, which failed, and he sought refuge in Paris.

VENTILATION, *ven ti la'shun.* See HEATING AND VENTILATION.

VENTRILOQUISM, *ven tril' o kwiz'm,* the art of speaking in such a way that the voice seems to come not from the speaker but from another source. Long practice is necessary to develop the art to perfection. The ventriloquist is able to "throw his voice," or produce the illusion of distance chiefly by proper control of his larynx. He draws a full breath, speaks without moving the muscles of his face, neck or chest, expelling the air through a narrow glottis. The ventriloquist's success depends largely on his skill in directing the imagination of his audience. The human ear is not quick to detect the direction from which a sound comes, and if a listener's attention is directed to a particular location his imagination is apt to associate it with the sound he hears.

VEN′UE, CHANGE OF, a change in the county or judicial district in which a case in law is brought to trial. It is made for the convenience of witnesses or on motion of the defense because prejudice on the part of the court or community precludes a fair trial in the jurisdiction where the action is brought. Change of venue is regulated by statute.

VE′NUS, the Roman name for the goddess of love. The Greeks called her APHRODITE. By some accounts she was the daughter of Jupiter, but according to the most popular legend she was born from the sea foam, near the island of Cythera. She was brought up by the nymphs in their ocean caves, and when she had attained the fulness of her size and beauty, she was conducted to Olympus, where she excited the greatest admiration. All of the gods wished to marry her, but she scorned them all, and as a punishment she was compelled by Jupiter to marry Vulcan, the ugliest of the gods. He gained no great happiness from the union, for Venus always despised him and bestowed her love on Mars and on the mortals Adonis and Anchises. Cupid was her son by Mars, and Aeneas was her son by Anchises. Venus was the special protectress of all young people who were in love, but she does not seem to have continued her interest in their affairs after they were once married. She was consequently chiefly worshiped by young people.

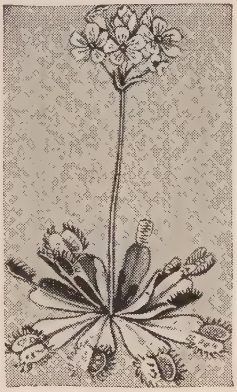
VENUS, one of the smallest but the most brilliant and conspicuous of the planets, second from the sun, its orbit lying between Mercury and the Earth. To the ancients, Venus was known as *Lucifer,* morning star, and *Hesperus,* evening star, according as it was seen after sunset or before sunrise. As evening star on clear moonless nights it may be observed to cast a shadow, its reflecting power being three times as great as that of the moon, due probably to a dense atmosphere and the presence of many clouds. The diameter of Venus is 7,700 miles, and it is 67,200,000 miles distant from the sun. Its sidereal revolution is performed in 225 days; its rotation period remains in doubt, because of difficulty of observation. It has various phases, according to the position it occupies, appearing as a thin crescent, gradually increasing to a full circle and then decreasing until it disappears.

Transit of Venus, the passage of the planet Venus across the disk of the sun, an occurrence of unsurpassed interest to astronomers and the entire scientific world. A full transit of Venus across the center of the sun's disk occupies about eight hours, the time being shortened when it occurs nearer the edge of the disk. Transits of Venus were observed in 1874 and 1882, and will occur again in 2004 and 2012.

VENUS DE MILO. See SCULPTURE.

VENUS'S FLOWER BASKET, a beautiful sponge, whose skeleton looks like spun glass, woven into an exquisite pattern, so delicate and white that one can scarcely believe it to be a natural skeleton. It is found in the deep sea near the Philippine Islands.

VENUS'S FLY′TRAP, or **DIONAEA,** *di o ne′a,* a plant of the sundew family, the leaves of which serve as traps for insects, upon which the plant feeds. It grows in the sandy soil of the North Carolina coast, and the insects it entraps are necessary to supply it with the nitrogen lacking in the earth. A flower stalk bearing a cluster of small white flowers rises from a rosette of leaves which spring directly from the ground. Each leaf is divided into two parts, the lower, flat and bladelike in appearance, and the upper, a roundish portion, consisting of two lobes, divided by a midrib. On the surfaces of the lobes are sensitive, hairlike processes, and along the edges are sharp bristles. When an insect alights on one of these sensitive hairs, the two lobes come together like a trap. A fluid is secreted by means of which the plant assimilates the juices of the animal. When the food is exhausted the leaf opens. After a leaf has captured several insects it loses its vitality and dies. See SUNDEW.


VENUS'S FLYTRAP

VERA CRUZ, *va'rah krooz,* MEXICO, the chief seaport of the republic, situated on an arm of the Gulf of Mexico, about 190 miles east of Mexico City. Though the site is low and sandy and the climate somewhat unhealthful, the construction of sanitation and port works has greatly improved conditions and has prevented the recurrence of periodic outbreaks of yellow fever. At the entrance of the fine harbor is the picturesque old fortress of San Juan de Ulloa, formerly used as a prison, but now only an interesting relic of colonial days. The city itself, with its encircling wall built of coral, is very attractive. Buildings of recent construction include a customhouse and a post and telegraph office, both constructed of cement, and the handsome building of the general lighthouse board, erected on land reclaimed from the sea. The dwelling houses of Vera Cruz are built of coral limestone in Spanish style.

The streets of the city are narrow, but are straight and well-kept, and are paved with asphalt over a wide area. Liberty Boulevard is the handsomest thoroughfare, and there are two public gardens. Prominent institutions include Vera Cruz Institute (a high school), the naval school, the only one of the kind in Mexico, the public library and a hospital. There are several factories, and fishing is an important occupation. Vera Cruz has a large, commodious harbor, with modern docks and other improvements, and enjoys a large general trade. Regular lines of steamers from the United States, the West Indies and Europe visit the port, and four railway lines meet here.

The city was founded by Cortez in 1520. During the Mexican War it was captured by Americans, and in 1914 it was temporarily occupied by United States marines as a result of Huerta's insult to the flag (see MEXICO, subhead *History*). To the Americans chief credit is due for making the city sanitary, for during their occupation they cleaned it thoroughly. The population is about 123,500.

VERB. The verb is that part of speech which expresses action or that tells what some object is or does, as, "The boy *runs,*" "The man *lifts* the stone," "Fishes *swim,*" "He *suffers* much," "The leaves *are* green." Verbs usually have the power of indicating time and mode, by means of tenses and moods, these varying in the different languages, as does also the conjugation, or system of verbal inflections and forms as a whole.

According to their relation to objects, verbs are classed as *transitive* and *intransitive.* A transitive does or may take an object, as "John *struck* Harry." An intransitive verb may not or cannot take an object, as "The tree *falls.*" Some verbs are used both transitively and intransitively, as "The boy *studies*" and "The boy *studies his lesson.*" According to their form in different tenses, verbs are *regular* or *irregular.* A regular verb forms its past tense and past participle by adding *d* or *ed* to the present tense form, as *live, lived.* Irregular verbs form their past tense and past participle otherwise, as *give, gave.*

Transitive verbs are in the *active* or *passive voice,* according to their representation of the subject as *acting* or as *being acted* upon, as "The sun *attracts* the earth," "The earth *is attracted* by the sun." *Auxiliary* verbs are those used with principal verbs to indicate mood and tense, as "The man *is* here," "The man *was here* yesterday," I *will* go tomorrow." *Inflection* of a verb is giving the changes in form to denote person, number and tense. *Conjugation* is the process of systematically carrying a verb through all its different moods, tenses, persons and numbers, in both active and passive voices, if it is a transitive verb.

VERBENA, *vur be' nah,* a genus of tropical and subtropical American plants of the vervain family, several species of which are cultivated for the beauty of their flowers. The cultivated varieties have creeping or spreading stems and bear their blossoms in dense, showy spikes, of almost every color except yellow. The wild varieties are often troublesome as weeds. The verbena of the perfumers is the lemon grass, from which the oil of verbena is extracted.

VERDI, *ver'de,* GIUSEPPE (1813–1901), the greatest composer of opera Italy has produced. He was born at Roncole, near Parma, the son of a poor storekeeper. He early showed a fondness for music, and at the age of eight began his studies with the village organist. Later he was taught for three years by the organist of a neighboring village. Verdi then went to Milan and placed himself under the conductor of the famous Scala Theater. In 1839 an opera of his was accepted by the Scala management, and the price paid for it—about four hundred dollars—was more money than the composer had ever before possessed in all the combined years of his life. Verdi had married some years previously, and the struggle with poverty had been a hard one.

After the production of his first opera, Verdi received commissions for others, and in 1842 he enjoyed a substantial success with *Nabucodonosor.* Two other successes followed in 1843 and 1844, *I Lombardi* and *Ernani.* The latter, with a libretto based on Victor Hugo's *Hernani,* was a triumph for its composer in England and other European countries. There followed a period of too many undertakings and too rapid composing; the operas produced during the next few years are unknown today. Then, in 1851, Verdi scored an instantaneous success with *Rigoletto,* one of the most popular operas in modern repertoires. Equally popular have been his *Il Trovatore* and *La Traviata,* both produced in 1853.

Even greater triumphs were in store for him. In 1870 the khedive of Egypt invited the composer to write an opera for the opening of the Grand Opera House in Cairo, and in 1871 *Aïda* was presented before an audience that was captivated, as are present-day audiences, by its stirring music and colorful, dramatic story. *Otello* and *Falstaff,* composed in Verdi's old age, reveal a further ripening of his powers. He also composed sacred pieces—a *Requiem* and a *Te Deum.*

VERDIGRIS, *vur′ de grees,* a greenish substance that forms on copper exposed to acetic acid. It is used principally in the composition of paints and Paris Green, in manufacturing dyes and as an ointment or liniment. Taken internally, it is poisonous. White of egg and milk are antidotes.

VERDUN, *vair duN′,* or **VERDUN-SUR-MEUSE,** FRANCE, a historic fortified city on the Meuse River, 175 miles northeast of Paris on an almost direct line between the French capital and Metz. Here are a beautiful twelfth-century cathedral and a ninth-century Benedictine abbey. The city has normally a few factories, but it is not important industrially. Verdun was built on the site of an ancient Roman fort, Verodunum, from which it derives its name. The treaty dividing the empire of Charlemagne among his three grandsons was signed here in 843 (see CHARLEMAGNE). The city was held by the Germans from the tenth century until 1552, and was seized again in 1792 and in 1870. But Germany was unable to take Verdun in its drive on Paris in 1916, in the First World War (see below). The French made good their boast "They shall not pass," but the long siege almost entirely destroyed the city. It was largely rebuilt after the war, only to be under German control from 1940 to 1945, during World War II. Population, about 19,500.

Battle of Verdun. After the war of 1870-1871 Verdun was made a first-class fortress, having about it a thirty-mile ring of sixteen large forts and twenty smaller works. The great attack on the outer defenses was begun in February, 1916, General Pétain commanding the French forces. During the seven months of fighting, the Germans gained 130 square miles of territory, but failed to capture the heart of the fortress; had they succeeded they would have made a breach in the Allied defense of Paris. In October a counter-attack under General Nivelle was begun, which was followed by a second offensive in December. The French reached the second line of defenses by February, 1917, and began a third offensive in August. A succession of smashing blows drove the Germans back until all the dominating positions were in French hands. The Battle of Verdun is counted a great Allied victory. The losses were heavy on both sides; it is believed the Germans lost over half a million men.

VERESTCHAGIN, *vyeh reh shchah′gin,* VASILI (1842–1904), a Russian painter, noted especially for his pictures of war scenes. He was born at Novgorod, and was educated in Saint Petersburg (Leningrad) and in France and Germany. Among his productions are a series of paintings based on the expedition of 1867 against the Central Asian provinces, *The Departure of Napoleon from Moscow* and *Roosevelt at the Head of the Rough Riders.* Verestchagin depicted the cruel side of war with remarkable realism. He was killed in the Russo-Japanese War, while on a battleship which was sunk by the Japanese.

VERGIL, *vur′ jil* (70–19 B. C.), the common designation of Publius Vergilius Maro, a great Roman poet, author of the *Aeneid.* He was born near Mantua, in northern Italy, and was the son of a small landowner. His education, which was careful and thorough, was received at Cremona, Milan, Naples and Rome, where he became thoroughly acquainted with the Epicurean philosophy. A naturally retiring disposition and a delicate constitution, together with the fact of his not being by birth a Roman citizen, would have checked any aspirations he might have had to the calling of the soldier, the orator or the statesman. He retired to his father's estate, with the intention of passing his life in the pursuit of poetry and agriculture, but was rudely disturbed by the allotment of his farm to the soldiers of Octavius, after the Battle of Philippi (42 B. C.). He recovered it through the aid of Asinius Pollio, the Roman governor; but further troubles arose, and he abandoned it, going at the instance of friends to Rome, where soon afterward he became acquainted with Maecenas and Octavius, to whom Pollio had recommended him. Through these powerful friends he received an estate in Campania and was enabled to devote his life to his favorite pursuits.

Vergil had become a great favorite of Octavius, and when, after the Battle of Actium (31 B. C.), the latter became Augustus, the poet was not forgotten. It was under the encouragement and patronage of the emperor that Vergil's greatest work, the *Aeneid*, was written; and indeed only the firm establishment of the Empire and the glorious achievements of Augustus in war and peace could have produced such an epic. During the years of its composition the poet recited selections before the imperial household. When the *Aeneid* was brought to a close, Vergil went to Athens, intending to spend a few years in revising the poem and completing certain unfinished parts. Soon afterward Augustus arrived in Athens from the East, and he induced Vergil to accompany him to Italy. Under the strain of seasickness and exposure to the strong sea air, his delicate constitution broke down, and he barely lived to reach Italy, dying at Brundusium, Sept. 21, 19 B. C. Rather than leave his life-work, the *Aeneid*, imperfect and incomplete, he ordered it burned, but finally yielded to the request of Augustus, that its revision might be entrusted to his friends Tucca and Varius, who edited it with the utmost care. The first of Vergil's poems of which the authorship is certain are the *Bucolics*, or *Eclogues*. While based on the model of the *Idyls* of Theocritus, these ten poems are by no means solely pastoral in character. Many contain allusions or are entirely devoted to current political events or to matters concerning the poet, the background and language alone being pastoral. The *Georgics* comprise four books of didactic poems on agricultural subjects. Book I deals with the tilling of the soil; Book II, with the cultivation of fruit trees; Book III tells of horses and cattle, and Book IV treats of bees. The *Georgics* are addressed to Maecenas and were said by some to have been written at his patron's request; the work is the most finished of all Vergil's poetry.

The *Aeneid*, the composition of which probably occupied most of the twelve years between the beginning of Augustus's reign and the poet's death, is Vergil's greatest work, although it is not as highly polished as some of his other poems. In general treatment of character and incident, it is inferior to its Greek models, the *Iliad* and the *Odyssey*; but certain parts are very successfully handled; and the whole poem is conceived in a spirit of delicacy, true culture and noble patriotism. In refinement of expression and elegant metrical construction, Vergil has not been surpassed. For an outline of the poem, see AENEID.

VERMES, *vur'meez*, or **WORMS**, that branch of the animal kingdom formerly including all invertebrate creatures (those without backbones) except the insects, but now restricted to such forms as earthworms, sea-worms and leeches. Most of the animals of this division have long, flat or cylindrical bodies, which are divided more or less distinctly into segments which have no limbs. Many of the Vermes are parasites, and some live in the intestines of human beings, where they cause great discomfort. See ZOÖLOGY.

VERMICELLI, *vur me chel'le* or *vur me sel'le*. See MACARONI.

VERMIFORM, *vur'me form*, **APPENDIX**, a long, slender, wormlike organ, which opens from the colon near its lower end. It is normally from three to four inches in length and is hollow to its tip. It is in the right side of the lower abdomen and projects upward in most cases. It performs no bodily function, but is the source of appendicitis (which see).

VERMIL'ION, a bright red pigment, named from a French word meaning *little worm*, because formerly crimson, or carmine, was obtained from a small red worm. The vermilion of commerce is obtained by mixing together in a revolving drum, mercury, sulphur and a solution of potash in water, and heating the mixture to about 115°, when it gradually assumes a red color. Vermilion is a permanent color and can be used with water or oil, but volatilizes at red heat and cannot be used for enamels. Cinnabar, a sulphide of mercury which occurs in large quantities in California, Brazil, Spain, China and other countries, is also a valuable source of vermilion.

VERMONT′, the second largest of the New England states, popularly called The Green Mountain State, *green mountains* being an English translation of the French words *verts* and *monts,* from which *Vermont* is derived. The state is appropriately named, for its picturesque mountains with their wooded slopes are among the most charming phases of New England scenery. The flower emblem of the state is the red clover.

Location and Area. Vermont lies directly south of the Canadian province of Quebec, and its southern boundary follows the northern Massachusetts line. It is bounded on the east by New Hampshire, from which it is separated by the Connecticut River, and on the west by New York. It is therefore the only New England state having no coast line. The western boundary, however, follows the deepest channels of Lake Champlain for more than one hundred miles, and over half the lake belongs to Vermont. Along the northern boundary the state is ninety miles wide; along the southern, but forty. From north to south it is about 150 miles in extent. Its area is 9,609 square miles, of which 331 square miles are water. Maine, the largest New England state, is over three times as large as Vermont, which ranks forty-second in size among the states of the American Union.

People and Cities. In 1950, with a population of 377,747, Vermont was the forty-fifth state in number of inhabitants. At the same time there was an average of 40.7 persons to the square mile, ranking Vermont twenty-ninth among the states in density of population; the average density for the entire United States was 50.0 in 1950. The rural population of the state comprised 63.6 per cent of the people.

Vermont has a fairly homogeneous population. Canadians of French descent have entered the state in considerable number, but they have been rapidly assimilated. The state's rank in population has remained the same for the last three censuses; there has been no great increase in population for the larger towns and cities or for the state as a whole. In 1950 there were eleven municipalities with more than 5,000 inhabitants and twenty-two with more than 2,500. The largest were Burlington, 33,155; Rutland, 17,659; and Barre, 10,922. Montpelier, with a population of 8,599, is the capital.

Surface and Drainage. The entire state is mountainous, owing to the presence of the Green Mountain range, which extends from the Canadian border into Massachusetts, and to numerous parallel ranges, which extend in a nearly north and south direction. The Taconic range lies in the southwestern part of the state and is parallel to the main range. There are also several short ranges in the northern and eastern sections. The highest peaks of the main range from north to south are Jay, Sterling, Mansfield, Camel's Hump, Lincoln, Pico, Killington, Shrewsbury, Stratton and Haystack, of which Mount Mansfield, with an altitude of 4,406 feet, is the highest. There are forty-one peaks having an altitude of 3,500 feet or more. All of the mountains of the parallel ranges are comparatively low, have rounded summits and are well timbered. These various ranges are separated by low, broad valleys, through which one or more streams flow and which have fairly fertile soil. The lowest point in the state is the valley of Lake Champlain. In general the surface is a combination of forest-clad hills and mountains, beautiful valleys and sparkling lakes and streams.

The eastern half of the state is drained by the Connecticut River and its tributaries, the most important of these being the Passumpsic, the Waits, the White, the Ottaqueechee, the Williams, the Saxtons and the West. The western part of the state is drained into Lake Champlain and thence into the Saint Lawrence River. The most important streams flowing into the lake are the Missisquoi, the Lamoille, the Winooski and the Otter Creek, the last being the largest river wholly within the state. The southwestern section is drained into the Hudson River by the Battenkill and the Hoosic.

The most important lake is Lake Champlain, more than half of which belongs to Vermont. Other lakes in the Champlain Valley are Bomoseen, Saint Catherine and Dunmore. In the northeastern part of the state is Lake Memphremagog, a portion of which is in Vermont and the remainder in Canada. Southeast of this is Willoughby Lake, renowned for its peculiar surroundings. The lake is about six miles long and lies between two mountains which seem to have been rent asunder in some past geologic age. This region also contains numerous other smaller lakes, frequently known as ponds. All of these bodies of water have become favorite summer resorts.

Climate. The climate of Vermont is subject to extreme and sudden changes. In summer the temperature varies from 65° to 90° in winter it ranges from 18° to 45°. At Burlington the mean annual temperature is 45°. The climate is milder in the Champlain Valley than east of the Green Mountains. During the winter there is often much snow, which in the colder parts of the state covers the ground for three months. The average annual rainfall is thirty-seven inches. The air is clear and pure.

Mineral Resources. The chief mineral wealth of the state is in its quarries. No other state in the Union produces so great a variety or quantity of marble and granite, and Vermont has practically become the center of the marble and granite industries. The value of the annual output of granite exceeds $3,000,000; the largest quarries are at Barre and Woodbury. The marble industry is chiefly in Rutland County. Roofing and other slate are obtained in large quantities, and the output is of fine quality.

Agriculture. The soil in the valleys along the streams and at the foot of the mountains and hills is usually fertile, though but very little of it compares favorably in this respect with the soils of the great prairie states in the Mississippi Valley. Agriculture is the leading industry of the state. The farms are comparatively small, averaging less than 200 acres, and most of them are tilled by their owners. Formerly Vermont was known for its production of wheat, oats, corn and potatoes, but since the development of the great agricultural states in the Missippi Valley, the New England states have been unable to compete in the markets which the Western producers could reach; consequently, in recent years methods and products have been radically changed. Now intensified farming is generally practiced and the raising of wheat has given way to the raising of corn, which is very generally used as ensilage. Dairying is the chief agricultural industry. Excellent qualities of butter and cheese are made, and these find ready market in Boston and other Eastern cities. In the output of these products the state ranks among the first ten. Vermont has always been famed for the excellent breeds of horses produced there, and horses are still raised in large numbers. In some sections the raising of garden vegetables and apples for market is also a profitable industry, and Vermont is unsurpassed in the United States in the quality and quantity of maple sugar produced.

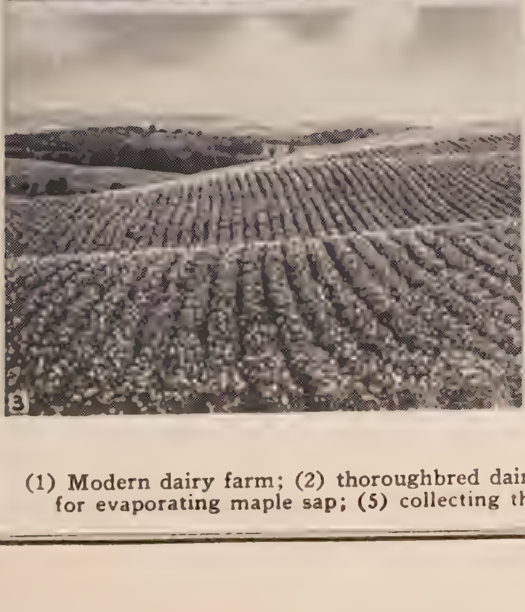
Manufactures. The chief manufacturing industries include dressing stone particularly marble and granite; the manufacture of scales, centered in Saint Johnsbury and in Rutland; the production of flour and other grist mill products; the manufacture of lumber products, and the manufacture of textiles, particularly woolen goods. Since the introduction of electrical power, many small factories have been established within the state, obtaining their power from mountain streams which were previously useless. This has increased the output of manufactures very materially since 1890.

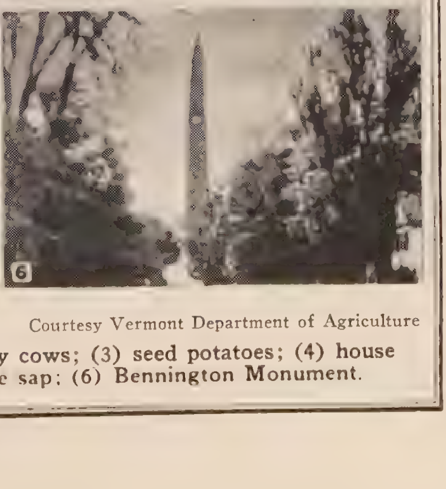
Transportation. The northwestern part of the state finds a ready outlet by water through Lake Champlain and the Richelieu River, but these are closed to navigation during the winter season. Lines of railway traverse the state from north to south, both on the eastern and western sides. There are also numerous cross lines so that every county has good railway facilities, and nearly every town is on a line of railway or within ready access of it. The railways of the state are under the control of the Rutland, the Canadian National and the Vermont Central systems; the total mileage is about 1,075. A number of electric lines connect near-by towns.

Government. The legislature consists of a senate of thirty members and a house

VERMONT

THE GREEN MOUNTAIN STATE





Courtesy Vermont Department of Agriculture

(1) Modern dairy farm; (2) thoroughbred dairy cows; (3) seed potatoes; (4) house for evaporating maple sap; (5) collecting the sap; (6) Bennington Monument.

of representatives of 246 members, the latter containing one representative for each town and city within the state. Both senators and representatives are elected every two years. The legislature meets biennially. The executive department consists of a governor, lieutenant-governor, secretary of state, treasurer and auditor, elected by the people for two years. The judiciary consists of a state supreme court of five judges, a superior court of six judges, a chancery court and county courts. The judges of the supreme court, the superior judges and some other officers are elected by the legislature. The state sends one Representative to Congress.

Education. The commissioner of education is at the head of the public-school system. The township system is in vogue, in which the town constitutes the smallest unit for school purposes. Supervision is by districts in which several adjoining towns are united. A superintendent who devotes his entire time to the work is appointed for each district. Graded schools are maintained in all the larger towns and villages, most of which have high schools.

The higher institutions of learning are the University of Vermont, at Burlington, with which is connected the State Agricultural College; Middlebury College, at Middlebury; and Norwich University at Northfield. Montpelier Seminary, at Montpelier; Goddard Ladies Seminary, at Barre; Saint Johnsbury Academy, at Saint Johnsbury; Vermont Academy, at Saxton's River, and Brigham Academy, at Bakersfield, are among the most prominent academies.

There are several teacher-training institutions in Vermont. They are as follows: the University of Vermont—a four-year course; state normal schools at Castleton and Lyndon—two-year and three-year courses; state normal school at Johnson—two-year course.

Institutions. The charitable and correctional institutions of the state include the state penitentiary for men at Windsor, the woman's reformatory at Rutland, the industrial school at Vergennes, the state asylums for the insane at Waterbury and Brattleboro, the soldiers' home at Bennington and the state sanatorium at Pittsford. There are also ten hospitals under the control of the state authorities.

History. The first white man to enter the territory of Vermont was probably Champlain (1609), but no settlements were made until 1665, when French trading posts were established on the western border. Vermont was the scene of numerous expeditions by both French and English during the French and Indian Wars. After the middle of the eighteenth century, the territory was a cause of dispute between New Hampshire and New York, each claiming jurisdiction over it, by reason of charters and royal grants. On account of the grants of lands made there by New Hampshire, Vermont came to be known as the *Hampshire Grants.* It was finally decided by England that New York had jurisdiction, but the settlers of Vermont, by means of organized militia, known as "Green Mountain Boys," resisted the establishment of the authority of New York. Several skirmishes followed.

During the Revolution, Vermont organized its own forces and fought effectively against the Indians and British in the north. Meantime it set up a claim of independent statehood, and existed as an independent commonwealth for fourteen years, until it was admitted into the Union, March 4, 1791. Its progress during the nineteenth century was consistent. Its government in most respects was rather more democratic than that of other New England states. During the Civil War it furnished its full quota of troops and it was the scene of the operations of the Fenians in 1864 and 1870. In 1852 an amendment prohibiting the sale of intoxicating liquors was adopted, but was repealed in 1902, local option being substituted.

In proportion to its population Vermont has been second to none in the number of eminent men it has furnished the nation. President Calvin Coolidge was her most distinguished son. Admiral George Dewey and Captain Charles E. Clark of the *Oregon* were noted Vermonters; President Chester A. Arthur, Vice-Presidents Levi P. Morton and William A. Wheeler and Justin S. Morrill were also Vermont citizens.

Related Articles. Consult the following titles for additional information:

CITIES

Barre
Bennington
Burlington
Montpelier
Rutland

PHYSICAL FEATURES

Champlain, Lake
Connecticut River
Green Mountains
Memphremagog (lake)
Taconic Mountains

HISTORY

Allen, Ethan
Champlain, Samuel
Coolidge, Calvin
Green Mountain Boys
Revolutionary War
Ticonderoga

VERMONT, University of, a coeducational institution of learning, founded in 1791 at Burlington. In 1862 the university was assured a share in the benefits of the land-grant act passed by Congress, and three years later the Vermont Agricultural College was incorporated with it. The full title of the institution is The University of Vermont and State Agricultural College; it comprises the colleges of arts and sciences, engineering, agriculture and medicine. There is a student enrollment of about 2,000 and a faculty of about 275. The library contains more than 180,000 volumes.

VERNE, *vairn,* Jules (1828–1905), a popular French romancer. He studied law for some time, but afterward began writing short pieces for the stage. He then began to write stories of adventure. The highly imaginative and fantastic exploits he recounted were given an air of plausibility by the author's manner of presenting them as scientifically possible. He wrote narratives of voyages on and under the sea, of travel on earth and flights in the air, foretelling, in the guise of fiction, some of the modern achievements of men who have traveled in submarines, automobiles and airships. His first essay in the vein of the marvelous was *Five Weeks in a Balloon.* This was followed by *Twenty Thousand Leagues under the Sea, From the Earth to the Moon, Around the World in Eighty Days, Michael Strogoff* and *The Mysterious Island.* Most of his books have been translated into English and the various European languages, and some even into Arabic and Japanese. They will long remain popular for their ingenuity and their lively style. *Michael Strogoff,* a story of Russian adventure, was a great stage and motion-picture success.

VERONA, *va ro'nah,* Italy, next to Venice the most famous city in the Venetian plain. The city is so old that an old Roman amphitheater built by the emperor Diocletian still stands; it was for many years a ruin, eloquent of the dead past, but has been restored. This building is over 500 feet long and is 106 feet high; it was built to seat 20,000 people. In the vicinity of the busiest part of the town is a marble tablet marking the spot where the people believe Juliet lived, and to whose house came Romeo. Through the town runs the swiftly-flowing Adige River. Verona suffered bomb damage in World War II. Population, about 187,900.

VERONESE, *va ro nay' zah,* Paul (1528–1588), the popular name of Paolo Cagliari, an eminent Italian artist, born at Verona. He studied painting under his uncle, Antonio Badile, and worked successively in Venice, Rome and other cities of Italy; but Venice was his chief residence. Some idea of his talent may be gained from the fact that he was soon recognized as a rival of Titian and Tintoretto. He was an excellent colorist, as were most of the Venetian school, and he was distinguished by the richness and fertility of his imagination. His pictures are exceedingly numerous and varied in subject. Among his masterpieces are *The Marriage at Cana* (now in the Louvre), *The Calling of Saint Andrew to the Apostleship, The Rape of Europa, The Family of Darius at the Feet of Alexander, Adoration of the Magi, Consecration of Saint Nicholas and Saint Helena* and *The Vision of the Invention of the Cross.* The last five mentioned are in the National Gallery. Veronese died at Venice in the full maturity of his genius.

VERON'ICA, Saint, a female saint, who, according to legend, met Jesus Christ bending under the weight of the cross and offered him her veil to wipe the sweat from his brow. The divine features were found miraculously impressed on the cloth, and this veil was brought from Palestine to Rome, where it is still preserved by the canons of Saint Peter's. Milan and other places claim they have the genuine veil.

VERRAZANO, *ver a tsah' no,* Giovanni da (1480?–1527), a Florentine navigator, about whose life little is known. About 1523 he made his first voyage of discovery, and in 1524 he voyaged to America, probably touching the coast of North Carolina. He wrote a letter to Francis I, describing this voyage, and this letter is almost the only source of information concerning his discoveries. Some accounts relate that Verrazano was hanged as a corsair; others state that he died while preparing for another expedition to America. The exact truth may never be known.

VERSAILLES, *ver sah'y',* France, the capital of the department of the Seine-et-Oise, situated twelve miles southwest of Paris. The town is noted as the location of the magnificent Palace of Versailles, erected in 1661 by Louis XIV and since that time the scene of a number of important and dramatic events in the history of France and of the world. Here, in 1871, the French signed the hard treaty terms which concluded the Franco-German War; in July, 1919, the victorious Allies concluded in the same palace peace terms with Germany at the close of World War I (see VERSAILLES, PALACE OF; VERSAILLES, TREATY OF). From 1871 to 1879, Versailles was the seat of government of the republic of France. Population, about 70,200.

VERSAILLES, PALACE OF, the famous residence of the Bourbon court and subsequent place of meeting of many important conferences for the adjustment of national and international affairs, including that following World War I. The palace was built as a residence by Louis XIV in 1661, at a cost of $100,000,000. It was permanently occupied by the court about 1682 and remained its center for a hundred years, or until the overthrow of the Bourbons at the opening of the French Revolution. Since that time it has been used principally as a vast museum, its collections representing the development of French history and art from the time of Clovis to the present day. Especially interesting is a collection representing the era of the Crusades.

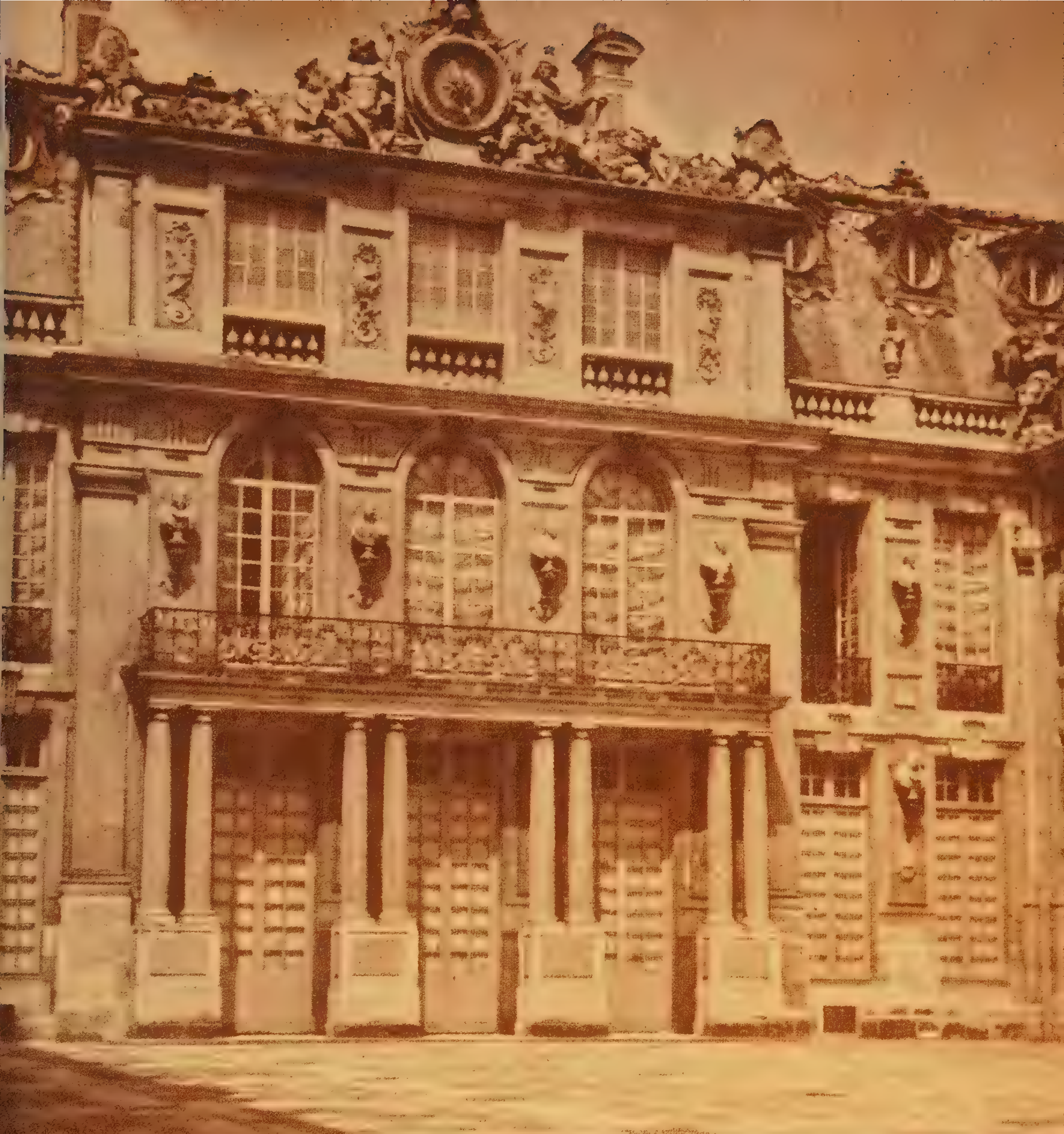
The Versailles palace is three stories high, in form a great square with wings at either side and at the back projecting into its surrounding park. It has an imposing façade a quarter of a mile long, above which are inscribed the words, *A toutes les gloires de la France* ("To all the glories of France"). The extensive Versailles gardens are filled with terraces, fountains, decorative ponds and artificially arranged trees and plants.

With the palace are associated the names of Madame de Pompadour, Madame du Barry and Marie Antoinette. Here was signed the Treaty of 1783 between England, France and Spain on the same day that England recognized the independence of the United States. Here, in 1789, was held the meeting of the States-General which formed the opening act of the French Revolution. During the Siege of Paris, 1870-71, King William of Prussia made his headquarters here, and here he was proclaimed Emperor William I of Germany. Again, in 1919, the interest of the world centered on Versailles, as the conference of the powers adjusted anew the affairs of a world shaken by the four years of the First World War, this time with a new diplomacy based on the principles of a League of Nations. See the article NATIONS, LEAGUE OF.

VERSAILLES, TREATY OF, the name of the treaty which formally concluded World War I, negotiated by representatives of the Allied powers on the one hand, and those of the Central Powers, including Turkey, on the other. There were four separate treaty agreements, made with Germany, Austria, Bulgaria and Turkey, respectively. The preliminary work on the agreements was carried on in Paris, but the name Versailles is applied to the treaty because the actual signing of the agreement with Germany, the head of the Teutonic alliance, took place in Versailles, a suburb of Paris. The German treaty was the first one negotiated, and was signed in the famous Hall of Mirrors, in the Palace of Versailles, in the same room where, in 1871, William I was crowned emperor of Germany at the close of the Franco-German War.

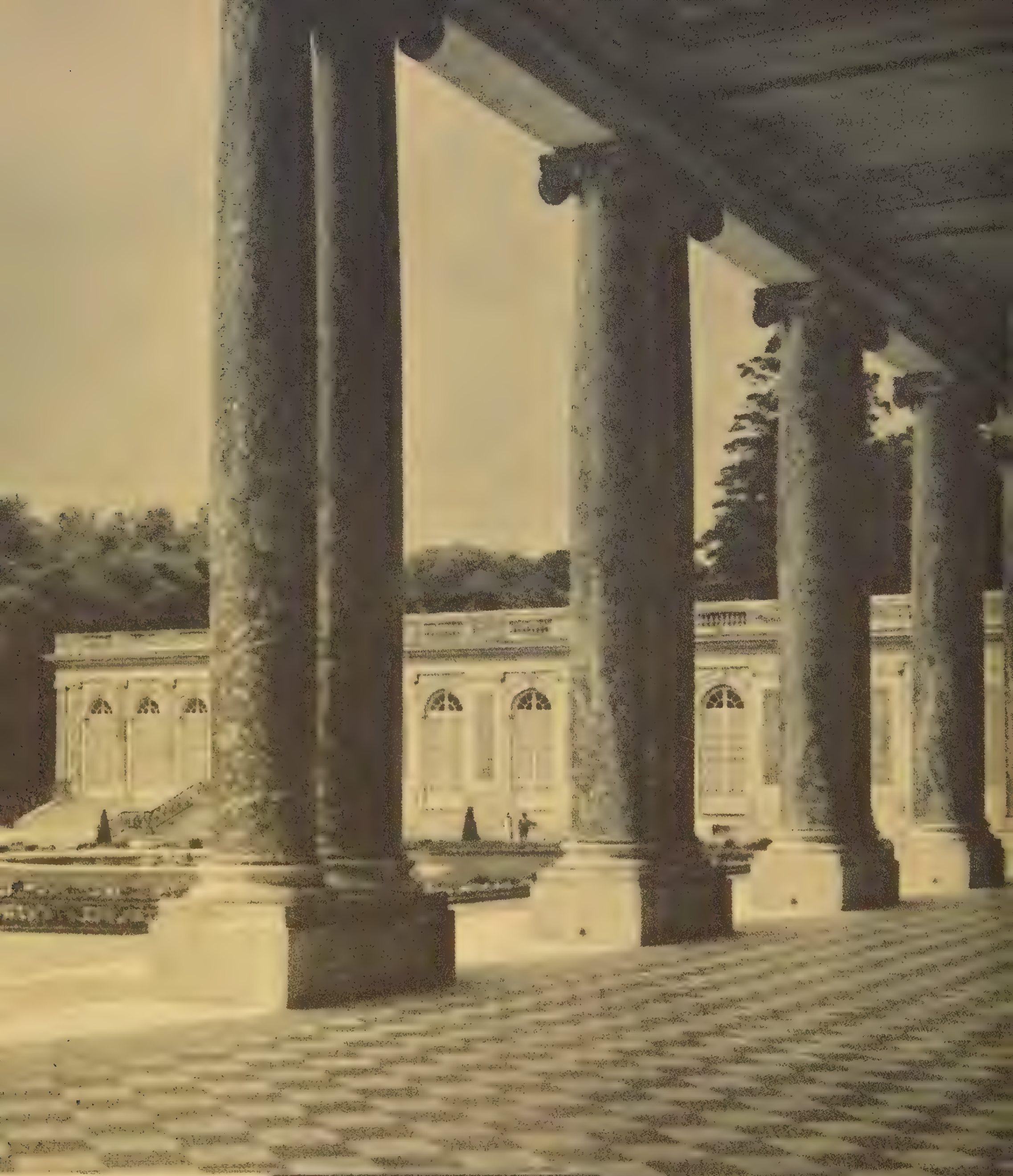
The peace conference began its sessions at Paris on January 18, 1919. The United States, the British Empire, France, Italy and Japan were represented by five delegates each; Brazil, Belgium and Serbia were represented by three each, and there were two each from China, Greece, Poland, Portugal, the Czechoslovak Republic, Rumania and the kingdom of Hedjaz. Two delegates were allotted respectively to Australia, Canada, South Africa and India, and one to New Zealand, as these British possessions had made great sacrifices for the Allied cause Other minor nations were allowed one delegate each, namely, Siam, Cuba, Guatemala, Haiti, Honduras, Siberia, Nicaragua, Panama and Montenegro. Each delegation acted as a unit. The most influential group consisted of the heads of the American, British, French and Italian commissions—President Woodrow Wilson and Premiers Lloyd-George, Clemenceau and Orlando. They were termed "the Big Four."

The conference held its sessions in the building of the Ministry of Foreign Affairs, meeting in a splendid reception room originally called Salle d'Horloge (Hall of the Clock). It required nearly six months to negotiate a treaty with Germany. On May 7, 1919, 109 days after the associated powers had begun their deliberations, German envoys received the terms on which the victorious powers were willing to make peace. The head of the German commission was



ine PALACE OF VERSAILLES

Above is a view of the Marble Court of he Grand Palace. The building is set in he midst of beautiful gardens, adorned vith statues and fountains. The largest ountain is the Basin of Neptune, a porion of which is pictured at the right. At ight, when colored lights are turned on he playing waters, the fountains are a



French Line

IN VERSAILLES PARK

Above, peristyle of the Grand Trianon
one of the architectural treasures o
the great park extending beyond th
grounds of the Grand Palace. Th
Grand Trianon, a smaller palace, wa
built by Louis XIV in 1685, as a resi
dence for Madame de Maintenon. A
left, a distant view of the Gran

Count von Brockdorff-Rantzau. A period of fifteen days was allotted the German envoys in which to reply to the terms. An extension of the period was granted, however, and German counter proposals were not delivered until May 29. On June 16, a revised version of the treaty, which had been slightly modified, was tendered the Germans, and on that date the delegation started for Germany. The German National Assembly at Weimar ratified the revised treaty on June 22, and on June 28 the terms were signed in Versailles. It was found necessary to appoint a new commission, the original envoys refusing to sign. A summary of the terms follows:

How Germany Paid. Germany was stripped of all colonial possessions, required to cede certain portions of its European domain, and forced to agree to the payment of heavy indemnities.

Territorial Changes. The following changes in Europe were authorized:

To France—Alsace-Lorraine, 5,600 square miles.

To Belgium—Two small districts (Eupen and Malmedy) between Holland and Luxemburg, 382 square miles.

To Poland—Part of Silesia and most of Posen and West Prussia, 12,504 square miles.

To League of Nations—Mouth of Memel River and internationalized area around Danzig, 729 square miles; basin of the Saar (internationalized temporarily), 738 square miles.

Southeastern third of East Prussia, and Vistula River district, 5,785 square miles, voted to join Poland and Czechoslovakia. North half of Schleswig-Holstein peninsula, 2,787 square miles, voted to join Denmark.

France was given the right to use the output of the Saar coal mines for fifteen years. A vote was to be taken at the end of that period to decide the future status of the Saar valley. (In January, 1935, the people voted to return to German sovereignty.)

The following changes in colonial possessions were authorized.

Togoland and Kamerun—Divided between France and Great Britain.

German East Africa—Under the mandate of Great Britain.

German Southwest Africa—Under the mandate of Union of South Africa.

German Samoan Islands—Under the mandate of New Zealand.

Caroline, Marshall and Ladrone Islands—Under the mandate of Japan.

New Guinea—Under the mandate of Australia.

Total, about 1,139,800 square miles.

German concessions in China, notably Kiaochau and the Shantung peninsula, were transferred to Japan.

Other Conditions. Germany lost most of its navy and most of its merchant marine, and the army was ordered reduced to 100,000 men. Possession of fourteen submarine cables was ordered relinquished, and sovereignty over the Kiel Canal, the Rhine and other important rivers was lost. Reparation for war damage was set at about thirty-one billion dollars (later reduced; only a little paid, with balance in doubt twenty years later). Luxemburg was freed from the German customs-union. Germany was required to recognize the independence of German Austria and Czechoslovakia, French control in Morocco and the British protectorate in Egypt. Though not admitted as a member, Germany was required to recognize the principle of the League of Nations, the provisions for which occupied the first section of the treaty.

Austrian Settlement. The complete text of the Austrian treaty was handed to the Austrian delegation at Saint Germain, France, on July 20, the first section having been tendered on June 2.

There were boundary disputes with Yugoslavia, Czechoslovakia and Italy, but eventually Austria was reduced to the following territories:

PROVINCE	AREA (Sq.mi.)	POPULATION AT THE TIME
Lower Austria	7,569	3,298,661
Upper Austria	4,628	858,795
Salzburg	2,763	214,200
Styria	6,327	953,684
Carinthia	3,684	366,589
Tyrol	4,790	306,304
Vorarlburg	1,005	133,212
Burgenland	1,586	296,891
Total	32,352	6,428,336

Austria's army was limited to 30,000 men, and the country was required to guarantee reparations for damages and to assume a portion of the debt of the old empire.

Turkish Settlement. It was the general opinion that the Turkish Empire should be dismembered; such an act would end the Turkish question that had vexed Europe for more than half a century. Some of the powers desired that the Turks should be forced out of Europe altogether, but finally they were permitted to retain Constantinople and Adrianople, with a small surrounding area (9,257 square miles). In Asia Turkey was reduced in size practically to the peninsula of Anatolia, ancient Asia Minor. It lost Palestine, Syria, Mesopotamia (Iraq), Lebanon, and all of Arabia. Besides Anatolia and a small area in Europe, it was permitted to retain only a few small islands in adjacent Mediterranean waters.

Bulgarian Settlement. The little country of Bulgaria had received acquisitions of territory at the conclusion of the Balkan Wars of 1912-1913, but most of these gains were surrendered after its defeat as an ally of Germany in World War I. The Treaty of Neuilly gave the Southern Dobrudja to Rumania and an area on the southwest to Greece, and deprived Bulgaria of a sea front on the Aegean; to Yugoslavia it lost territory on the west. Its only outlet by water is on the Black Sea.

Later History. It was the determination of the Allied powers to force Germany to pay for the war, in addition to imposing territorial losses. Beyond the tentative $33,000,000,000 in indemnities, interest charges would increase the payments to an incredible sum. It was a sullen country that faced its almost impossible task. By 1923 its protests were heeded. A commission headed by Gen. Charles G. Dawes reported in 1924 that payments must not be pressed beyond Germany's ability to pay, which was estimated at about $600,000,000 a year.

By 1929 a crisis impended in connection with payment of war debts to the United States by European powers; the latter contended that they could pay only as German reparations payments continued, and that Germany could not meet its obligations. Another commission, headed by Owen D. Young, fixed the total payments at $8,800,000,000, installments to run for fifty-eight years. With the rise of Hitlerism, Germany repudiated the entire debt and demanded a revision of the Versailles treaty. Between 1935 and 1939, Hitler nullified much of the treaty by reoccupying the Rhineland and annexing Memel, German Poland, Austria, Bohemia and Moravia. Hitler used the treaty as a stepping stone to power, calling on Germans to right its "injustices." Meanwhile, the Allies relied on appeasement and refrained from military action to enforce the terms of the treaty. World War II terminated the treaty.

VERSE, *vurs,* a line of poetry, or, more commonly but less correctly, a stanza composed of several lines. The term is also used, in its broader sense, to mean the measured and cadenced form of speech or composition adopted in poetry. Verse, as simply cadenced lines, is of great antiquity, but the use of rhymed cadences is comparatively modern Blank verse is verse in which the lines do not end in rhymes. For the classifications of verse on the basis of meter, see METER. See also BLANK VERSE.

VER'TEBRATES, or **VERTEBRA'TA**, is the name given to those animals that have backbones. The backbone, or spinal column, is made up of many separate bones called vertebrae. Vertebrate animals are *bilaterally symmetrical.* By this we mean that the right and left halves of their bodies are almost exactly alike. The skeleton of vertebrates is made of cartilage or bone. It is located inside the body, rather than outside as in lobsters and other lower animals. A skull, or cranium, protects the brain. Vertebrates usually have no more than two pairs of limbs. They have a well developed nervous system and sense organs. The spinal cord runs from the brain down along the back (dorsal) side of the body. It is located inside the backbone. Vertebrates breathe by means of internal gills or lungs.

Vertebrates form a subdivision of a larger animal group, the phylum Chordata. At some stage of their lives, all chordates have a flexible supporting rod called the notochord within their bodies. In vertebrates a notochord is present during the embryonic stage. As the vertebrate animal develops, the notochord is replaced by the backbone. Vertebrates are divided into seven classes: lamprey eels and hagfishes; sharks, skates, and rays; bony fishes; amphibians; reptiles; birds; and mammals.

Related Articles. Consult the following titles for additional information:

Amphibians
Birds
Carnivora
Cetacea
Fish
Mammals
Marsupials
Primates
Reptiles
Rodents
Ungulates
Zoology

VERTIGO, *vur' te go,* an attack of giddiness, in which stationary objects appear to move in various directions, the person affected finding it difficult to maintain an erect position. It is a common symptom of excessive or defective supply of blood to the brain, as well as of nervous and general debility, though it also frequently arises from the disturbance of the digestive organs. Rapidly whirling the body will produce a severe form of vertigo.

VESPASIAN, *vez pa' zhe an* (9–79), emperor of Rome. After serving with distinction in Germany and in Britain, as commander of a legion, he was made consul. He afterward became proconsul of Africa; and on the rebellion of the Jews, he was sent with an army into Judea. He reduced nearly all Galilee and was preparing to attack Jerusalem when he received news of Nero's death (A. D. 68). Then followed the emperors Galba, Otho and Vitellius, and in A. D. 69 Vespasian was himself elected emperor by the army. He left the siege of Jerusalem to his son Titus and returned to Rome. He immediately reformed the discipline of the army, purified the senatorial and equestrian orders and improved the administration of justice. He was the patron of learned men, particularly Quintilian, Pliny and Josephus. He rebuilt a part of the city, restored the capitol and erected the gigantic amphitheater, the ruins of which are still celebrated under the name of the *Colosseum.*

VESPUCCI, *ves poot′ che,* AMERIGO. See AMERIGO VESPUCCI.

VES′TA, a Roman divinity, the goddess of the hearth. She was worshipped, along with the Penates, at every family meal, when the household assembled round the hearth, which was in the center of the room. Her public sanctuary was in the Forum, and the sacred fire was kept constantly burning in it by the vestal virgins, her priestesses. A special building, near the temple, was set aside as the dwelling of the vestals. Each community had a hearth, on which was kept constantly alight the sacred fire of Vesta, and colonists setting out from a city took with them some of the old fire to kindle a flame in their new home. Few legends are connected with Vesta.

VESUVIUS, *ve su′ vi us,* the only active volcano in Europe, situated on the Bay of Naples, in Italy. Its first recorded eruption took place in A. D. 79, when the city of Pompeii was buried under twenty feet of loose ashes and Herculaneum was covered by a torrent of mud. The elder Pliny, in command of the Roman fleet at Misenum, sailed to the relief of the distracted inhabitants, but was suffocated with them by volcanic vapors. The catastrophe is graphically described by his son, the younger Pliny, in two letters written to Tacitus, long after the event.

Another eruption of Vesuvius occurred in the year of 472, when ashes were carried as far as Constantinople. In 1794 and in 1822 there were also violent eruptions, and a series of lesser eruptions took place in the latter part of the last century, beginning with 1865. Eruptions occurred also in 1906 and 1944. The mountain is a state of constant activity, and, being of easy access, has been studied by more scientists and visited by more tourists than any other volcano in the world. An electric railway takes passengers from Naples to within 450 feet of the crater, and under direction of a guide visitors may descend some distance into the crater. An observatory is located on the west shoulder of the mountain, at an elevation of 2,200 feet.

Geologically, Vesuvius is thought to be of recent origin. It is a solitary mountain, with a base about thirty miles in circumference, and is surmounted by two summits. The higher one, Vesuvius proper, is the cone from which are emitted the streams of lava. The lower one, known as Mount Somma, partly encloses the active cone. The mountain varies in height according to the amount of material thrown out or carried away by eruptions; it averages about 4,000 feet above the sea level.

Related Articles. Consult the following titles for additional information:

Herculaneum
Naples
Pompeii
Volcano

VETCH, a common name rather loosely applied to several genera of climbing plants that are natives of the temperate zones. Many of them have been cultivated as forage plants for ages, and some yield edible seeds. Several species have been introduced into the United States for winter forage; the *hairy vetch* makes a good crop yielding from two to four tons of hay an acre. In Europe *spring vetch,* or *tare,* is more common. The plant has bluish-pink flowers resembling those of the pea, and compound leaves.

VETERANS' DAY. See ARMISTICE.

VET′ERINARY MEDICINE, the art which deals with the nature, causes and treatment of the disorders of the domestic animals. The first veterinary school was instituted in 1762 at Lyons, France; in 1766 that at Alfort, near Paris, was opened. A similar institution was established at London in 1791, and in the year following, one in Berlin. In the United States veterinary chairs have been added to the University of Pennsylvania, Cornell University and several other leading universities, as well as to many of the schools of agriculture. Besides these, there are many private schools that give thorough instruction. Requirements of admission to veterinary courses have been materially advanced, and in the better schools four-year courses of study are required.

The veterinarian must have a thorough knowledge of the anatomy and physiology of domestic animals, and of the causes and effects of the diseases common to them. Moreover, he must be a keen observer, for he must rely solely upon his observation in making a diagnosis; the horse or the cow cannot tell him how it feels or where pain is located. All states and the Canadian provinces require every veterinarian to possess a diploma from an approved school, or to take a rigid examination before he is allowed to practice.

One of the most valuable services that the veterinarian renders is the detection and prevention of contagious diseases among domestic animals, and his services for this purpose are usually authorized by the state, which maintains a board or commission, whose duty it is to see that the laws for preventing the spread of contagious diseases among domestic animals are enforced.

The Bureau of Animal Industry, in the United States Department of Agriculture, takes care of veterinary questions that come before the government, and the states and large cities have veterinarians who investigate diseases and attend to the enforcement of the veterinary laws of the districts in which they have power. Important documents are issued for public circulation by the Bureau of Animal Industry and by the experiment stations and boards of agriculture in the several states. In its progress veterinary medicine has kept pace with human medicine.

VE′TO, from the Latin, meaning *I forbid,* refers to the power of a chief executive to negative any legal measure originating in a lawmaking body. There are several forms of veto power, which may all be included in two main classes—*absolute* and *limited.* In the case of the former the executive action is final; in the case of the latter the legislature may override the executive decision, if an extraordinary majority is in favor of the bill.

In Great Britain the veto of the ruler is absolute, but the power has not been exercised since 1708. In France the veto is limited, of the form known as suspensive; that is, the President may suspend the operation of a law and demand its reconsideration. A similar form of limited veto is in effect in the United States, where the Presidential veto may be overriden by a two-thirds vote of the members of each house of Congress.

VI′ADUCT, a structure for carrying a waterway or roadway across a valley or lowland or over a public highway. Viaducts of the older type usually consist of a series of arches of brick work, masonry or spans of steel, but of late they have been largely constructed of reinforced concrete. The viaduct crossing the Kaw River valley, connecting Kansas City, Mo., and Kansas City, Kan., has a length of 8,400 feet. The viaduct at Des Moines, Iowa, used by the Chicago & North Western Railroad, is 2,685 feet in length. Other notable viaducts are those over Tunkhannock Creek and Martin's Creek on the Lackawanna road, the one across the Pecos River in Texas, the viaduct over the White Elster at Goltsch, Saxony, and that at Gokteik, Burma. See BRIDGE.

VIC′AR, in a general sense, a representative or deputy authorized to perform the duties of another. In the Church of England a vicar is the priest of a parish, who receives only the smaller tithes, or a salary. In the United States the large city parishes which support two or more churches maintain a vicar for the clerical duties of the chapels.

In the Roman Catholic Church *vicar apostolic* is a bishop who possesses no diocese, but who exercises jurisdiction over a certain district by direct authority of the pope; *vicar-general* is the official assistant of a bishop or archbishop. The Pope calls himselt the *Vicar of Christ on earth.*

VICE-ADMIRAL. See ADMIRAL.

VICE-PRESIDENT, the official of the United States government who is second in executive authority to the President. The Vice-President is chosen in the same way and for the same length of term as the President. A candidate for Vice-President must be a natural-born citizen of the United States, must have reached the age of thirty-five years and must have been for fourteen years a resident of the United States. He is inaugurated in the Senate chamber at Washington on the same day and immediately preceding the inauguration of the President. His chief duty is to preside over the sessions of the Senate. He is not allowed to vote, except in case of a tie. He becomes President if the President dies or is permanently incapacitated from performing his duties. Tyler, Fillmore, Johnson, Arthur, Theodore Roosevelt, Coolidge, and Truman succeeded to the Presidency through the death of the President. The Vice-President's salary is $45,000 a year.

VICE′ROY, an official who rules a province or colony in the name of a sovereign, therefore, a vice-king. Viceroy is also the name of a butterfly resembling the monarch.

VICKS'BURG, Miss., third largest city in the state and the county seat of Warren County, forty-three miles west of Jackson, on the Mississippi River at the mouth of the Yazoo, on two lines of the Illinois Central System. It is served by the Federal Barge Lines on the Mississippi River. The city is built on a range of hills about 350 feet above sea level, and is surrounded on three sides by the Vicksburg National Military Park, which is adjoined on its northern boundary by the National Cemetery. A state charity hospital is located here, as is the United States Waterways Experiment Station, one of the largest hydraulic laboratories in the world.

Vicksburg is the commercial center for a large agricultural area that produces cotton, corn, hay, and truck and fruit crops. It is also a cotton and hardwood market, and has numerous cotton-manufacturing industries, as well as lumber milling, foundry and sheet-metal manufacturing, and oil refining. Repair shops of the Yazoo & Mississippi Valley Railroad are located here.

Settlement began in 1811 with the Reverend Newitt Vick. In 1824 the town was laid out on part of his plantation; it was incorporated in 1825 and chartered as a city in 1836. During the early part of the Civil War it was strongly fortified; and after a long siege it was surrendered to General Grant on July 4, 1863. Population, about 28,000.

VIC'TOR EMMAN'UEL II (1820–1878), king of Sardinia, the son of Charles Albert. His aptitude for a military career became evident when he commanded the Savoy brigades against Austria (1848–1849), and he distinguished himself in the Battle of Goito by his reckless valor. After the Battle of Novara his father abdicated, and Victor Emmanuel ascended the throne of Sardinia. He had then to negotiate with Austria under most unfavorable circumstances, but he steadily refused to give up the principle of representative government in the Sardinian constitution, and this gained for him the good will of the Italian people. Under the advice of his celebrated minister, Cavour, he regulated the finances, reorganized the army, and secularized the Church property, for which he was excommunicated by the Pope.

Victor Emmanuel took part in the Crimean War against Russia, and in 1859, assisted by France, he renewed the contest with Austria, winning the battles of Magenta and Solferino. By the Treaty of Villafranca and the Peace of Zurich, which followed these successes, Lombardy was added to his dominions, but he had to cede Savoy and Nice to France. Parma, Modena, and Tuscany now became united to Sardinia, and Garibaldi's successes in Sicily and Naples brought the whole of southern Italy over to Victor Emmanuel. Early in 1861, he assumed the title of king of Italy. By the Peace of Vienna (1866) Austria ceded Venetia, and on the withdrawal of the French garrison from Rome in 1870, that city annexed itself to Italy. The king entered Rome on July 2, 1871, and took up his residence in the Quirinal. He was succeeded by his son Humbert.

Related Articles. Consult the following titles for additional information:

Cavour, Count Camillo
Crimean War
Garibaldi, Giuseppe
Humbert I
Italy (history)
Sardinia, Kingdom of
Savoy, House of

VICTOR EMMANUEL III (1869–1947), king of Italy, the only son of King Humbert I, whom he succeeded in 1900. He entered the army at the age of eighteen and advanced to the rank of general. Victor Emmanuel married Princess Helena, daughter of Nicholas, king of Montenegro, in 1896. The Crown Prince, Humbert, was born in 1904, and in 1930 married Princess Marie Jose of Belgium. Victor Emmanuel assumed active command of the Italian armies on the Austrian front in World War I, and shirked neither hardship nor danger. Under the Fascist regime of Mussolini, the king was little more than a figurehead, but he had become a popular ruler, sympathetic with and interested in his people. Through Mussolini's conquests, he became "Emperor of Ethiopia (1936) and King of Albania" (1939). When Rome was liberated by the Allies during World War II, Victor Emmanuel (on June 5, 1944) named his son lieutenant-general of the realm, retaining only his title "King of Italy and head of the house of Savoy." Growing republican sentiment led him to abdicate on May 9, 1946, and go into exile in Egypt. His son, who succeeded him as Humbert II, followed him into exile after Italy became a republic on June 2 and banished the house of Savoy.

VICTO'RIA (1819–1901), a beloved Queen of the United Kingdom of Great Britain and Ireland, and Empress of India. She was the only child of Edward, Duke of Kent, fourth son of George III, and was born at Kensington Palace. The duke died when Victoria was only eight months old, and she was brought up by her mother with exceptional prudence and care. Upon the death of her uncle William IV, June 20, 1837, she ascended the throne and was crowned at Westminster, June 28, 1838. The English people knew little of their young queen, who had been brought up in seclusion, but she soon proved herself possessed of the clear judgment and moderation which a sovereign needs, and of a thorough goodness which won the hearts of her subjects.

During the reign of Victoria there were eighteen changes of government, the following Premiers taking office at the dates given: 1835, Melbourne; 1841, Peel; 1846, Russell; 1852, Derby; 1852, Aberdeen; 1855, Palmerston; 1858, Derby; 1859, Palmerston; 1865, Russell; 1866, Derby; 1868, Disraeli; 1868, Gladstone; 1874, Disraeli; 1880, Gladstone; 1885, Salisbury; 1886, Gladstone; 1886, Salisbury; 1892, Gladstone; 1895, Salisbury.

VICTORIA

The leading events of the reign were the confederation of Canada; the Opium War in China; the abolition of the Corn Laws, under the administration of Sir Robert Peel; the successive steps in parliamentary reform; the enfranchisement of the Jews; the Catholic Emancipation act; the assumption of the government of India by the Crown; the Crimean War; the wars with Afghanistan, Abyssinia the Zulu tribes and Egypt; the long struggle on the Irish home-rule question the beginning of the South African War, and the Australian federation.

In February, 1840, Victoria was married to her cousin, Prince Albert of Saxe-Coburg-Gotha, and the marriage proved an unusually happy one. Four sons and five daughters were born to the royal couple. Victoria, Princess Royal, born in 1840, married in 1858 to Frederick William, afterward German Emperor, died in 1901; Albert Edward, Prince of Wales, born in 1841, married to Alexandra, daughter of the king of Denmark, succeeded to the throne on the death of his mother; Alice, born in 1843, married in 1862 to Prince Frederick William of Hesse, died in 1878; Alfred, born in 1844, married in 1874 to Marie, daughter of the Czar of Russia, died in 1901; Helena, born in 1846, was married in 1866 to Prince Christian of Denmark; Louise, born in 1848, was married in 1871 to the Marquis of Lorne; Arthur, born in 1850, was married in 1879 to Princess Louise Marguerite of Prussia; Leopold, born in 1853, married in 1882 to Princess Helen of Waldeck, died in 1884; Princess Beatrice, born in 1857, was married in 1885 to Prince Henry of Battenberg. In 1861 the Prince Consort died, and the queen withdrew from social life.

During the reign of Queen Victoria, Great Britain enjoyed a long era of uninterrupted prosperity; peace and contentment prevailed at home, and, with very rare exceptions, relations of amity were maintained with foreign powers. In length her reign was unprecedented in the world's history. It is true that Louis XIV of France ruled over a longer period than she, but subtracting the years during which he was under a regent, his responsible tenure of the crown was shorter than hers. Although George III nominally ruled sixty years, owing to his insanity a part of his reign was also under a regent.

In 1887 the people of Great Britain and the colonies celebrated the golden jubilee, or fiftieth year of Queen Victoria's reign. In 1897 they celebrated the diamond jubilee, with ceremonies more imposing than had ever attended any similar event. Representatives of all the colonies were present, and a grand procession, viewed by millions, moved through the streets of London. Victoria died January 22, 1901.

Related Articles. Consult the following titles for additional information:

Corn Laws
Crimean War
Great Britain (history)
India (history)
South African War

VICTORIA, a state of the Australian Commonwealth, situated in the southeastern part of the continent. Victoria is next to the smallest state of the Commonwealth, but is second in population. Only Tasmania has a smaller area, and New South Wales is the only state with more inhabitants. It is bounded on the north by New South Wales, on the south and southeast by the Indian

Ocean and on the west by South Australia. Its area is 87,884 square miles, or a little less than the areas of Virginia and North Carolina combined. It has about 600 miles of sea coast, with a considerable number of bays and indentations, especially about the middle, where Port Phillip Bay, with an area of 875 square miles and an entrance barely two miles wide, affords shelter sufficient for the largest fleet.

Surface and Drainage. The interior, though diversified by mountains, is chiefly distinguished by vast, unwooded plains, mostly occupied by pasture. There is one principal mountain range, a portion of the Great Dividing Range of Eastern Australia, running from east to west through the state, with various offshoots. The eastern portion of it, called the Australian Alps, with numerous northern and western ramifications, rises to 6,500 feet in Mount Bogong and to 6,100 feet in Mount Hotham, and has several other peaks exceeding 5,000 feet in height. The most westerly portion, called the Grampians, runs north and south, and in Mount William reaches a height of 5,600 feet. The Grampians and the Australian Alps are connected by such ranges as the Pyrenees and Hume Range, containing numerous cones and extinct craters. This is the region of the gold fields. The rivers are numerous, but they are generally small and dry up in summer, leaving the country parched. The chief is the Murray, which rises in the Australian Alps and forms the northern boundary of the state for 980 miles. It is 1,300 miles long and is navigable for several hundred miles.

The climate of Victoria is temperate, but liable to sudden changes; and hot winds blow at intervals from November to February, causing great discomfort. The hottest period of the year is in January and February, when the thermometer sometimes rises to 108° in the shade.

Industry and Trade. Victoria is one of the three leading gold-producing states, Queensland and Western Australia being the others. Tin, antimony, copper and coal mines are also worked, and there are valuable limestone quarries.

General farming is quite extensively followed. The chief crops among the cereals are wheat, oats and barley. Hay is grown, and forage crops are also raised. Among fruits, grapes take the lead, and considerable attention is given to the manufacture of wine. Stock raising is important, and wool growing is the chief branch of the agricultural industry.

The manufacturing industries are quite generally distributed, and include the manufacture of textiles, machinery, food preparations, butter and cheese, and malt and spirituous liquors.

Most of the commerce is with Great Britain, and in its foreign trade Victoria is the second state of the Australian commonwealth. The chief exports are wool, gold, fruit, dairy products and wheat. Railway lines extend to all the most important trade centers and connect these directly or indirectly with Melbourne, the chief city and commercial port. In all, there are about 4,800 miles of railway in the state.

Government. The governor, who is the chief executive officer, is appointed by the British sovereign. The legislature consists of a council of thirty-four members, who are chosen for six years, and an assembly of sixty-five members, elected for three years. Suffrage is granted to men and women on equal terms. Melbourne, the capital, is the second largest city of Australia, following Sydney. Population of the state, about 2,031,000.

Related Articles. Consult the following titles for additional information:

Australia
Ballarat
Melbourne
Murray River

VICTORIA, B. C., capital of the province, is situated on the southeastern extremity of Vancouver Island, on the Strait of San Juan de Fuca, seventy-five miles northwest of Seattle, Wash. It is within three miles of Esquimault, a naval base with one of the finest harbors on the Pacific coast. The city is well laid out and has good streets; excellent roads connect it with the surrounding country. The public buildings include the parliament house, the government offices and the provincial museum and library, the city hall, the courthouse, a marine hospital, the Anglican Cathedral and exposition buildings. Victoria is a favorite residential city. It has lumber mills, and is also the lumber distributing center for Vancouver Island. It also has a large trade in salmon. Originally a post of the Hudson's Bay Company, it was incorporated as a city in 1862, and until the founding of Vancouver was the largest Canadian city on the Pacific coast. Its foreign trade is large; great steamships connect with the Orient in regular sailings. The population is about 51,000.

VICTORIA CROSS, the most highly-prized British military and naval decoration, instituted as a recognition of valor in the presence of the enemy at the close of the Crimean War in 1856. It is granted to soldiers and sailors of any rank, including native officers and men of the Indian army. Up to 1913 only 522 crosses had been awarded; this number was considerably increased during the World War. The cross is the more valuable because it is awarded sparingly, and only for the most conspicuous acts of bravery and devotion to the Empire.

VICTORIA FALLS, a celebrated cataract in the Zambezi River, in Rhodesia, South Africa, discovered by Livingstone in 1855 and named by him in honor of Queen Victoria. After flowing for a long distance over a rough and broken plateau, covered with brush and stunted trees, the Zambezi plunges suddenly into a chasm nearly 400 feet deep. The falls, 3,000 feet in width and 360 feet in height, are the most magnificent in the world. At low water the fall is broken by projecting rocks and is described by an observer as resembling a film of delicate lace, but when the river is swollen during the rainy season, an unbroken sheet of water is hurled over the ledge, forming a cataract unequaled elsewhere in the world. The roar of the falls can be heard for twenty miles, and the cloud of spray thrown into the air is visible for ten miles. Because of this cloud, the natives named the cataract *Mosi-oa-tuni,* which means *roaring smoke.*

Below the cataract the Zambezi flows for a long distance through a narrow gorge, with nearly perpendicular walls of basalt. Just below the falls the Cape-to-Cairo Railway crosses the river on a magnificent steel bridge, 600 feet long and 420 feet above the water; it is the highest structure of the kind in the world. From this bridge a magnificent view of the falls is obtained.

VICTORIA NYAN'ZA, the largest lake in Africa, having a surface area of 26,000 square miles and after Lake Superior the largest body of fresh water in the world. It was discovered in 1858 by Captain Speke and named for Queen Victoria (*nyanze* is the local word for *lake*). It lies about 600 miles from the eastern coast and is crossed by the equator. It is fed by several streams, the most important being the Kagera to the west, and drains an area of 92,000 square miles, where there is an annual rainfall of seventy-five inches. It is the principal source of the Nile River. As the Nile issues from the lake it forms the Ripon Falls, which are about 1,200 feet across. The lake is rocky and shallow and is dotted with islands. Port Bell, Entebbe and Jinja are the principal ports.

VICUNA, *ve koo'nyah,* a small animal of the camel family, somewhat resembling a wild goat or an antelope, which inhabits the Andes Mountains in South America. It is economically valuable because of its soft, silky, brown wool, which is of better quality even than that of the alpaca. It is commonly seen in herds of from six to fifteen females and one male. The animals are very timid, and have never been domesticated.

VIEN'NA (German *Wien*), AUSTRIA, the capital of the Austrian Republic, is an old and beautiful city that was for centuries the home of the Hapsburg emperors and the chief metropolis of Central Europe. Situated on the Danube River, about 320 miles south and east of Berlin, Vienna stands at a point where the principal east-west and north-south highways of trade crossed in ancient times. It was called *Vindobona* by the Romans. Rail, water, and air transportation facilities are still centered there, between the eastern edge of the Central Alps and the broad Hungarian plains.

During the period when Vienna was the capital of a large empire, it was a city of great charm, luxury, and gaiety. Its name is forever associated with music, for Haydn, Gluck, Mozart, Beethoven, Brahms, Schubert, and many other musicians lived and worked there. The waltzes of the two Johann Strausses suggest the light-hearted brilliance of nineteenth-century Vienna. The University of Vienna, founded in 1365, has always been an important center of learning, and the city has been known for a long time for advanced research in medicine. Medical students from all over the world have gone to Vienna for training. The General Hospital is a famous institution, and there are other clinics and research centers. The Viennese doctor Sigmund Freud, the founder of psychoanalysis, was a great pioneer in the study of the human mind.

Description. Vienna is on a small plain on the west bank of the Danube. A channel called the Danube Canal or the Vienna Canal passes through the city. The main stream of the river, to the east, deepened and held in place by strong walls, serves as the port of Vienna. Mountains covered with forests rise above the plain. The railroad lines that radiate from the city like the spokes of a wheel follow the river valleys.

The oldest part of Vienna, the inner city, was originally a walled fortress just west of the Danube Canal. The center of the inner city is the Cathedral of Saint Stephen, which was begun in the twelfth century and largely completed by the fifteenth. The ramparts surrounding the old town were leveled in 1857, and a fine boulevard called the Ringstrasse took their place. Later another new boulevard made a still wider ring around the core of the city, taking in more of the near suburbs. The town hall, the parliament buildings, the opera house, palaces, and parks make the Ringstrasse and its neighborhood a very beautiful part of Vienna. On the island between the Danube Canal and the river itself is the famous park called the Prater. Schönbrunn, the summer home of the emperors, is near the southwest edge of the city. In spite of extensive damage from bombing, many buildings have been restored.

Industry and Trade. Vienna is both commercial and industrial. In the days when it was an imperial city, raw materials flowed in from the eastern regions, which were lacking in industrial development, and manufactured goods were shipped from the factories of Vienna to many parts of the world. Vienna was a world city, in contact with Western and Eastern Europe. Its people generally spoke German, but other languages were also common. Before World War I the city had more than two million inhabitants. The Viennese had a great reputation for wit and intelligence. They liked music, art, good food, and good talk.

The lands under the political control of Vienna shrank to a small fraction of the empire when the settlement was made after the war. After 1918 Austria became a small republic with an area of about 33,000 square miles and a population of some 7,000,000. About a quarter of the people lived in Vienna. With most of its sources of raw materials beyond the frontiers and its markets also restricted by tariff barriers, the city went through years of economic distress. Many of the industries in Vienna were luxury items of fine craftsmanship: art objects, leather goods, foods, musical instruments, optical goods, textiles, toys, and furniture. The worldwide depression of the 1930's made the task of building up the city's economy still more difficult, and Vienna had not recovered its place as the leader of Central Europe when Hitler annexed Austria to the German Reich in 1938. The Second World War restored Austria as an independent nation with the same boundaries, but it did not solve the problem of Vienna, which was put under temporary four-power control. Commerce was greatly hampered by the closing of communications beween Soviet-dominated Eastern Europe and the West.

History. Vienna has been on the border between the West and the East in Europe since the earliest times. It was a Roman stronghold against the barbarians beyond the Danube, and about A.D. 800 Charlemagne extended his empire to the east, creating the province called Ostmark, which later became Austria. Germanic people mingled with the earlier Celtic inhabitants. The city was several times attacked from the east as well as from the west. Huns and Magyars were followed by the Turks, who besieged Vienna and failed to take it in 1529 and again in 1683.

The Hapsburgs became dukes of Austria in 1286, and from 1438 to 1806 they were also Emperors of the Holy Roman Empire. As the capital of a world power, Vienna grew rapidly in political and commercial importance. Bohemia and Hungary were joined to the Austrian Empire in 1526. Napoleon occupied Vienna in 1805 and in 1809, and the Congress of Vienna, at which the boundaries of Europe were redrawn, took place there in 1814–15. The next century was a period of expansion in commerce, industry, and cultural development. It ended with the opening of the First World War. The population of Vienna is about 1,761,000. See AUSTRIA; HAPSBURG, HOUSE OF; WORLD WAR (I, II).

VIENNA, CONGRESS OF, a convention of representatives of European powers which assembled late in 1814 to reorganize the political system of Europe after the close of the Napoleonic Wars. It was a brilliant assemblage of rulers, prominent diplomats, and statesmen, of whom Czar Alexander I of Russia, Prince Metternich, the Austrian Minister of State, Prince Talleyrand of France, Castlereagh and Wellington of Great Britain, and Hardenberg and Humboldt of Prussia were among the most powerful.

By the provisions of the Congress of Vienna, France was deprived of the territory conquered by Napoleon; Holland and Belgium were united into a single kingdom under the House of Orange; Norway and Sweden were joined under a single ruler, one of Napolean's generals, and the independence and neutrality of Switzerland were guaranteed. The German states were loosely confederated under a diet at Frankfort. In Italy the old governments, consolidated under Napoleon, were restored. Poland was re-established as a constitutional kingdom dependent upon Russia. Great Britain found compensation in the extension of its colonial possessions.

The Congress of Vienna is criticized for its blindness to the spirit of nationalism that had been awakened throughout Europe by the events of the French Revolution. It defined boundaries arbitrarily, without consulting the peoples concerned, thus laying the basis of many disputes and future wars. The diplomatic method known as the balance of power, brought into prominence by this Congress, led to unending international complications that resulted in the bursting forth, in 1914, of World War I, the most widespread and violent conflict up to that time.

VIET NAM, *vee et' nahm,* is a country on the Indo-Chinese peninsula in Asia. China is on the north, the South China Sea on the east and south, and Cambodia and Laos are on the west. Viet Nam is made up of three states: North Viet Nam (Tonkin), Central Viet Nam (Annam), and South Viet Nam (Cochin China). These three states were part of French Indo-China for many years. The people wanted self-rule, and at the end of the Japanese occupation in World War II the nationalists attempted to establish a Republic of Viet Nam, which was to include Annam, Cochin China, and Tonkin. The Vietminh, a Communist-controlled party headed by Ho Chi Minh, emerged as the strongest of the nationalist groups. The French were able to re-establish some control in Indo-China in 1946. Discontent soon led to a full-scale civil war. Several unsuccessful attempts at peaceful settlement were made. France was willing to give more self-rule to the states but wanted them to remain in the French Union. By 1949, French control was such that Cochin China, Annam, and Tonkin were united into one state, Viet Nam, in the French Union. An anticommunist government headed by the former Emperor of Annam, Bao Dai, was given French approval. But Vietminh forces regained lost territory during the latter years of the war, and when the armistice was signed in 1954 they were able to bargain for 77,000 square miles of territory in northern Viet Nam. The total area of Viet Nam is about 125,450 square miles. The population is about 22,000,000. See also FRENCH INDO-CHINA; HANOI; INDO-CHINA; SAIGON.

VI'KINGS. See NORTHMEN.

VILLA, *ve'yah,* FRANCISCO, called PANCHO, real name DOROTEO ARANGO (1877–1923), was a Mexican revolutionist and bandit. He took part in the uprising against President Diaz in 1910, and in 1914 he joined Carranza in a revolution against President Huerta. Villa was badly defeated when he attempted to rise against Carranza in 1915. When Columbus, N. M., was invaded by Mexican raiders in 1916, John J. Pershing made an unsuccessful expedition into Mexico to capture Villa. He was assassinated in 1923. See also CARRANZA, VENUSTIANO; MEXICO.

VILLEIN, *vil'in.* In the Middle Ages, a peasant who had some degree of personal freedom but was bound to the land was called a villein. Legally he was not permitted to leave his holdings, and he was obliged to perform certain services for the lord of the estate. He was required to grind his corn at the lord's mill and to spend a specified number of days working the lord's land. The system began to decay after the Black Death took the lives of countless villeins. See also FEUDAL SYSTEM; PLAGUE.

VIL'LI are minute projections covering the mucous lining of the small intestine that aid in digestion. See INTESTINE.

VILLON, *ve-yawN',* FRANÇOIS (1431–about 1484), a French lyric poet. Born near Paris of a poor family named de Montcorbier, he was befriended and educated by a priest, whose name he adopted. After leaving school, Villon was banished for killing a priest in a street quarrel, but was pardoned when he proved that the act was done in self-defense. He continued to lead the life of a dissolute vagabond, was often in prison and more than once barely escaped hanging. Nothing is known of Villon after 1462. His poems, consisting of songs and ballads, give a vivid picture of his times. They have been translated by Swinburne, Andrew Lang, and others. Villon's exploits are the basis of an operetta, *The Vagabond King.*

VIL'NA, or **VIL'NYUS**, Lithuanian Soviet Socialist Republic, capital city, situated at the confluence of the Vileika and Viliya rivers, about 245 miles northeast of Warsaw. Vilna is an old city, dating from the tenth century. Before the annexation of Lithuania by Russia, in 1795, it was the Lithuanian capital. After World War I Lithuania became an independent republic, but Vilna was seized by Poland. In 1939, after Eastern Poland was annexed by Russia, the Soviet Union restored the city to Lithuania. Population, about 182,000.

VINCENNES, *vin senz'*, Ind., one of the oldest towns in the United States, the county seat of Knox county, 117 miles southwest of Indianapolis, on the Wabash River and on the Baltimore & Ohio, the Chicago & Eastern Illinois, the Pennsylvania and the New York Central railroads. It is in an agricultural region producing fruit, sweet potatoes, grain and livestock. Leading manufactures include glass, paper products, structural steel, foundry products, packed foods, carbonated beverages, shoes and creamery products.

The town is the seat of Vincennes University, a junior college. Other interesting features include the old house occupied by William Henry Harrison when he was governor of the territory; Harrison Park, and George Rogers Clark Memorial. Vincennes is located on the site of an Indian village called Chip-kaw-kay. The first permanent settlement developed around a fort built by the French in 1702. Originally called The Post, the settlement was named Vincennes in honor of the founder, François Morgan de Vinsenne. The place was captured from the British by Virginia troops under George Rogers Clark in 1779, and was acquired by the United States in 1783. It was the capital of Indiana Territory from 1801 to 1816, and became a city in 1856. Population, about 19,000.

VINCENT, George Edgar (1864–1941), an American educator and sociologist, son of Bishop John H. Vincent, born at Rockford, Ill. He graduated from Yale University in 1885. In 1888 he became vice-president of the Chautauqua system and in 1907 president of the Chautauqua Institution. At the same time he was a member of the faculty of the University of Chicago, having been appointed in 1894. In 1911 Professor Vincent became president of the University of Minnesota, and in 1917 resigned from that post to accept the presidency of the Rockefeller Foundation (which see), from which post he retired in 1929. He wrote voluminously on educational topics.

VINCENT, *vin'sent*, John Heyl (1832–1920), a Methodist Episcopal bishop, best known as one of the founders of the Chautauqua movement. He was born at Tuscaloosa, Ala., and was educated at Lewisburg (Pa.) Academy and at Wesleyan Institute, Newark, N. J. In 1865 he established the *Northwest Sunday-School Quarterly*, and the following year *The Sunday-School Teacher*. From 1868 to 1884 he was corresponding secretary of the Sunday-School Union of his denomination and editor of its publications. Ten years previous to the latter date he had helped to lay the foundations of Chautauqua Institution and in 1878 had become its chancellor. He was elected bishop in 1888, and twelve years later was appointed resident bishop in Europe, remaining abroad four years and then retiring from the active episcopate in 1904. His publications include *The Chautauqua Movement, The Church School and Its Officers, Studies in Young Life, A Study in Pedagogy* and *Family Worship for Every Day in the Year.* See Chautauqua Institution.

VINCI, *vin' che*, Leonardo da (1452–1519), one of the foremost scholars of the Italian Renaissance and one of the greatest artists of all time. His place in history is unique, not only because of the high quality of his art, but because of the versatility of his genius and his intellectual influence on his contemporaries. Such a combination of artistic and scientific capacities has not been known in any other man. Leonardo was distinguished not only as a painter, but as a sculptor, an architect, a musician and an engineer. As a philosopher and man of science he was the forerunner of Galileo, Bacon and Descartes. He was acknowledged the greatest physicist of the fifteenth century. He "united a remarkable knowledge of mathematics with the most admirable intuition of nature," and he "anticipated the grandest discoveries of modern science," says a modern scholar.

Leonardo was born at the small town of Vinci, near Florence, the son of a Florentine notary. In his youth he was distinguished for his great personal beauty, physical strength and eagerness for knowledge. After studies with the celebrated painter and sculptor Verrocchio he became an independent artist, and from the age of twenty onward enjoyed the most distinguished patronage; Lorenzo de' Medici, Ludovico the Duke of Milan and Francis I of France treated him with the highest honor. As architect, engineer, painter, sculptor and decorator, he received numerous commissions, and in everything he undertook he aimed at perfection.

His supreme masterpiece, *The Last Supper,* painted on a wall of the monastery of Santa Maria delle Grazie, at Milan, represents Christ, seated with his disciples, at the dramatic instant following His announcement that one of the twelve should betray Him. In characterization and dramatic and spiritual significance it surpasses all other treatments of the same subject. As time passed, the picture was exposed to dampness and smoke; and these elements, together with clumsy attempts to restore it, obliterated much of its original beauty. In 1947, an air-conditioned room was constructed around it to prevent further deterioration. The most celebrated of Leonardo's easel pictures, the *Mona Lisa,* is the portrait of a prominent Florentine lady; it is perhaps the most famous portrait in the world (see PAINTING). *The Virgin of the Rocks, The Virgin, Saint Anne and Christ* and *John the Baptist,* all in the Louvre, are his other chief masterpieces. Leonardo spent his last years in France in the service of Francis I.

VIN'EGAR, a sour liquid whose active principle is acetic acid, is made from the juices of fruits and vegetables and from almost any other liquid that will ferment. It is used as a condiment and in the pickling and preserving of foods. The vinegar of commerce is made from wine, cider or malt exposed to the air, usually at a heightened temperature until the alcohol which it contains turns into acetic acid. By far the largest part of the vinegar used in the United States is made from cider. Ohio, New York, Michigan and Missouri lead in the industry.

Cheap grades of vinegar are usually given their sour taste by the addition of sulphuric acid. This adulterated product is very unhealthful, and should not be purchased. The presence of the acid can be detected by boiling a mixture of vinegar and potato starch, and when this becomes cool, adding a small quantity of iodine. If the vinegar is pure, the mixture will turn blue on the addition of the iodine; if sulphuric acid is present, the color will remain unchanged.

VIN'LAND, the name given to that part of North America which was visited by Norsemen several centuries before Columbus made his famous voyage. As early as the tenth century a Norwegian viking, Bjarni Herjulfson, was driven by storms to the mainland near Greenland, and in the year 1000 Lief Ericson landed on the continent, probably somewhere between Delaware and Labrador. He named the region *Vinland* (also spelled *Vineland*) because of the numerous wild grapevines there. It is believed that the Norsemen settled at some point in America and that they built homes, which they deserted because of the hostility of Indians.

A common belief that the old mill at Newport, R. I., is evidence of this visit was popularized by Longfellow in his ballad "The Skeleton in Armor." The inscriptions on Dighton Rock, on Taunton River in Massachusetts, have also been attributed to the Norsemen, but on less evidence.

VINSON, FREDERICK MOORE (1890–1953), chief justice of the United States Supreme Court, born at Louisa, Ky. He received his law degree in 1911. After seven years in the House of Representatives, he became associate justice in the court of appeals in Washington, D. C. (1938). He headed several government bureaus during World War II. In 1945 he succeeded Henry Morgenthau as Secretary of the Treasury, and the next year was named by President Truman to succeed Harlan Fiske Stone as Chief Justice.

VI'OL, a class of ancient musical instruments, which may be regarded as the precursors of the modern violins. They were fretted instruments, with three to six strings, and were played with a bow. There were three instruments in a set, differing in pitch; these were the treble, tenor and bass viols, and in concerts they were commonly played in pairs—two treble, two tenor and two bass. The bass viol, or *viol da gamba,* developed into the modern *violoncello* (which see).

VI'OLET, the popular name given to a genus of plants, of which there are many species. They are favorite flowers in all northern and temperate climates, and many of them are among the first to make their appearance in the spring. The greatest favorites are the common sweet violet and the heart's-ease, the former being especially esteemed for its fragrance. The well-known pansies, so common as garden flowers, are but varieties of one species, produced by cultivation. In different localities, various species are called johnny-jump-ups. The dog-tooth violet belongs to the lily family.

VIOLIN′, a musical instrument, consisting of four catgut strings, the lowest of which is covered with silvered copper wire, stretched, by means of a bridge, over a hollow wooden body, and played with a bow. It is considered the most perfect of musical instruments, on account of its capabilities of fine tone and expression and of producing all the tones in any scale in perfect tune. It forms, with the viola, the violoncello, or bass violin, and the double bass, the main element of all orchestras.

The principal parts of the violin are the *scroll,* or *head,* in which are placed the pins for tuning the strings; the *neck,* which connects the scroll with the body, and to which is attached the *fingerboard,* upon which the strings are stopped by the fingers of the left hand, as it holds the neck in playing; the *belly,* over which the strings are stretched, and which has two *f*-shaped sound holes, one on each side; the *back,* or under side; the *sides,* or *ribs,* uniting the back and belly; the *tailpiece,* to which the strings are fastened, and the *bridge.* The back, neck and sides are generally of sycamore, the belly of deal, the fingerboard and tailpiece of ebony. Almost all the pieces are put together with glue.

The four strings of the violin are tuned at G, on the upper space of the base staff, D, A, E, reckoning upward. Every intermediate semitone in a compass of 3½ octaves may be produced by stopping the strings with the fingers, and the compass may be almost indefinitely extended upward by touching the strings lightly. The *viola,* or tenor violin, has four strings, tuned to C (in the second space of the base staff), D, A, G, reckoning upward; it is an octave higher than the violoncello and a fifth lower than the violin.

The art of violin-making reached its highest development in the sixteenth, seventeenth and eighteenth centuries. The greatest of the world's violin makers, Stradivarius, Amati and Guarneri worked at Cremona, Italy. Very fine instruments were also made at the same time in France and Germany.

VIOLONCELLO, *vi o lon chel′lo,* also called CELLO (*chel′o*), a large musical instrument of the violin class, intermediate between the violin and the double bass. The performer rests one end of the instrument on the floor between his knees, and supports the neck with his left hand. There are four gut strings, the two lowest covered with silver wire. They are tuned in fifths—C, G, D, A. The instrument has a compass from C to A^b. The higher notes are in the treble clef, the lower in the bass. Although the instrument is much larger than the violin, the cello bow is shorter. Comparatively little solo music has been written for the cello.

VI′PER, the name applied to a family of venomous reptiles found in tropical and temperate regions of Europe, Asia and Africa. This snake has a flat, triangular head, which in most species is covered with scales. The pupil of the eye is like a cat's eye. The *common viper* is rarely more than two feet long, is usually brownish-yellow, with black triangular spots on its sides and zigzag lines on its back. Its bite, as a rule, is not fatal, but may cause pain and fever. It is the only poisonous snake in Great Britain. Another species, called the *sand viper,* having a small fleshy horn on its nose, is found along the shores of Mediterranean countries. In Africa occur the *death adder, puff adder* and *saw viper.* The *horned viper* of the Egyptian desert, which preys at night and burrows in the sand during the day, is much feared on account of its bite, which is usually fatal. The largest and most deadly of all vipers is *Russell's viper* of India. It is five feet long, and its poison is invariably fatal.

VIRCHOW, *veer′Ko,* RUDOLF (1821–1902), a German physician and pathologist, born in Pomerania. He studied medicine at Berlin and early became famous as a lecturer on pathological anatomy at Berlin University. His advanced liberal opinions during the movement of 1848 induced the government to deprive him, temporarily, of his appointment. In 1849 he accepted a chair at Wurzburg, where he remained seven years, at the end of which time he returned to Berlin as professor in the university and director of the pathological institute attached to it. In 1858 he published *Cellular Pathology,* in which he showed that pathological tissues are a collection of cells. Virchow rendered immense service to medical science by his discoveries in regard to inflammation, ulceration, tuberculosis and other diseases. He was a voluminous writer, and many of his works have been translated into English and several European languages.

VIR'EO, a family of small, greenish, insect-eating birds of the Western Hemisphere. Twenty-five species are found in North America. Most of them are from five to six inches long. The upper parts are usually olive or greenish gray, the under parts white and yellow. Many vireos have a light eye ring which makes them look as though they were wearing spectacles. Vireos are sometimes mistaken for warblers, but they are more deliberate in their movements than the warblers, and their songs are louder and richer.

Among the common species in the United States and Canada are the *warbling,* the *red-eyed,* the *white-eyed,* and the *yellow-throated* vireos. The warbling vireo is grayish green above, without wing bars. Breast and abdomen are white, the sides yellow. The red-eyed vireo has a broad, white line over the eye. A yellow eye ring and two white wing bars mark the white-eyed vireo. The yellow-throated has a yellow eye ring, and both throat and breast are bright yellow.

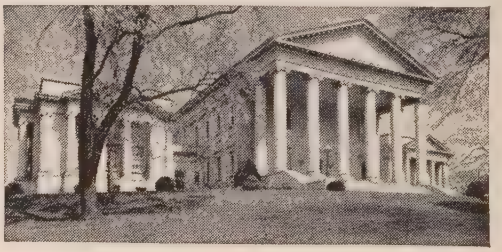
VIRGIL, *vur'jil.* See VERGIL.

VIRGIN ISLANDS OF THE UNITED STATES, a group of small, tropical islands in the Caribbean Sea, east of Puerto Rico. They are a part of a larger group in the West Indies, the other islands of that group being the British Virgin Islands. The American-owned islands were purchased by the United States from Denmark in 1917 for $25,000,000. The territory consists of three main islands—St. Thomas, St. Croix, and St. John—and about sixty small islets, most of them uninhabited. St. Thomas, which has a fine harbor, covers 32 square miles and has a population of about 14,000 persons. St. Croix has about 12,000 inhabitants in an area of 82 square miles, and St. John, which is mostly undeveloped, has about 750 inhabitants and an area of 19 square miles. More than two thirds of the people are Negro. The chief towns are Charlotte Amalie, the capital, on St. Thomas, and Frederiksted and Christiansted on St. Croix.

The islands are mountainous and beautiful, and the climate is pleasantly healthful because the northeast trade winds temper the tropical heat. The tourist trade is an increasing source of income for the people of the islands, who have had a very low standard of living for many years. The principal products of the islands are sugar cane, sugar, rum, bay rum, cattle, hides, and native craft work. Vegetables and fruits are grown in home gardens. Rum and bay rum are exported.

Under the Organic Act of 1936, which gave the islanders a larger share in their government, the executive power is in the hands of a governor, who is appointed by the President of the United States upon the recommendation of the Secretary of the Interior. The Department of the Interior has jurisdiction over the islands. Legislative power is vested in two municipal councils, one for St. Croix and one for St. Thomas and St. John jointly. The two councils unite as the legislative assembly to consider the problems of the islands as a whole. All citizens (both men and women) who are twenty-one years of age or over and can read and write English may vote for the councilors. The Virgin Islands Corporation and the Tourist Development Board are Federal corporations that were organized to help the islanders solve their economic difficulties.

The Virgin Islands were discovered by Columbus in 1493, and, because there were so many, he named them after the eleven thousand virgins of Saint Ursula. The United States purchased the group formerly held by Denmark largely as a way of protecting the approaches to the Panama Canal. In earlier years the harbor of St. Thomas was also an important point for steamers in need of coal.



VIRGINIA, the "Old Dominion," is a state rich in history, in scenic beauty, and in natural resources. Named for Elizabeth I, the Virgin Queen, Virginia was the site of the first permanent settlement made by the English in the New World. From colonial times it has given leaders to America; no less than eight of the Presidents were born in Virginia. Virginia's position in the upper tier of the Southern states brings it into close contact with the industrial and financial North and with the national capital. Although it is primarily an agricultural state, it has valuable fisheries and first-class shipbuilding facilities along the Atlantic seaboard, scattered industrial plants in many cities, and coal mines in the western mountains.

Location and Surface Features. Virginia is shaped like a rough triangle. The base, which runs in an east-west direction, is the boundary with North Carolina and Tennessee. On the east and northeast Virginia is bounded by the Atlantic Ocean, Chesapeake Bay, Maryland, and the District of Columbia. On the west and northwest are Kentucky and West Virginia. The western side of the triangle generally follows the line of the Allegheny Mountains, a part of the Appalachian range. (See state map with article STATE.)

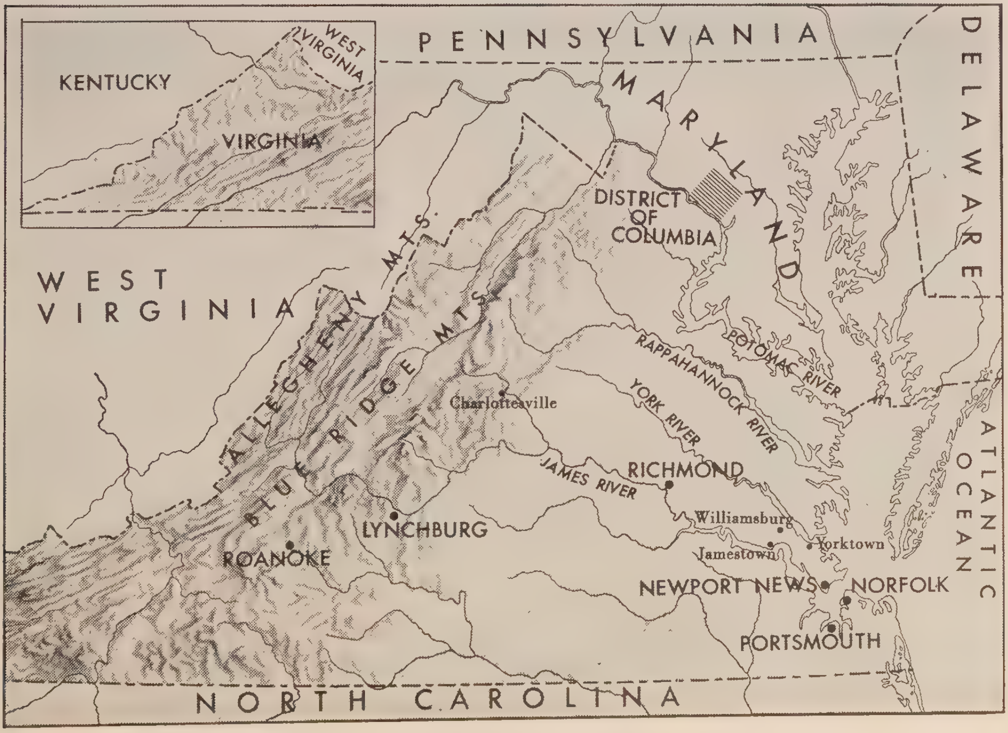
The coastal plain, or the Tidewater, is a flat or gently rolling region rising from sea level on the east to about 300 feet on the west. The wide tidal estuaries of the Potomac, the Rappahannock, the York, and the James rivers divide most of eastern Virginia into three peninsulas, and two counties on the eastern shore of Chesapeake Bay form a fourth.

The Piedmont, a rolling, stream-cut region, extends westward from the Fall Line (see PIEDMONT; UNITED STATES, *Surface Features*) to the foot of the Blue Ridge Mountains. Western Virginia is a series of mountain ridges and beautiful valleys. The Great Valley of Virginia, between the Blue Ridge and the Alleghenies, is the richest agricultural section of the state. It includes a number of smaller valleys like the beautiful Shenandoah. The highest point of the state is Mount Rogers (5,719 ft.), near the Tennessee border.

Woodlands cover almost three fifths of the state; most of the mountain region is forested. Cypress is abundant in the lower Tidewater, oaks and other hardwoods appear both in the Tidewater and the Piedmont, and yellow pine is common in the mountains. Lumbering is an important occupation, and industries using wood pulp and wood products account for about one tenth of the annual industrial output.

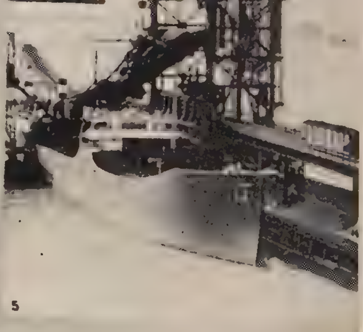
The eastward-flowing Potomac, Rappahannock, York, and James drain five sixths of Virginia. The Roanoke, which flows toward the southeast into North Carolina, is the largest of the several smaller rivers south of the James.

Climate. Virginia has a relatively mild and pleasant climate, with adequate rainfall. In the southeast, temperatures average 42°F. in January and 78°F. in July. In the upper Piedmont and the mountain regions the average temperature for the three coldest months is about 32°F. Rainfall varies between forty and fifty inches a year.



VIRGINIA

THE OLD DOMINION



Courtesy Virginia State Department of Commerce

(1) Blue Ridge Mountains. (2) Corn and tobacco, (3, 4) peanuts and cotton, products of Virginia's diversified agriculture. (5) Coal pier on Hampton Roads. (6) Rayon factory. (7) William and Mary College. (8) Virginia Colonial architecture.

People and Cities. The people of Virginia, who number more than 3,300,000, are almost all American-born. About one fourth of them are Negroes, and a few are descended from the Indians who once lived in the region. More than half of the Virginians live in the country; about 43 per cent are city dwellers. Most of the country people are farmers. They work some 150,000 farms averaging about 100 acres in size.

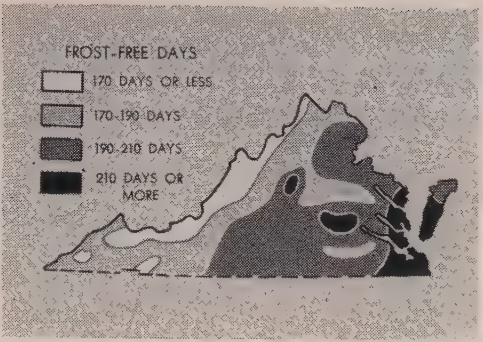
The Virginia cities are not very large. Only Richmond, the capital, and Norfolk, the center of shipbuilding and naval activity, count more than 200,000 inhabitants. But the state is close to many large centers of population from Washington northward, and markets for agricultural products and manufactured goods are close at hand.

Agriculture. Tobacco, corn, wheat, hay, peanuts, apples, and truck crops are the chief products of the land. In the Tidewater truck gardens, vegetables are grown for the markets of the big cities to the north. Suffolk, in the southeast, is the center of the peanut-growing industry. Further west, in parts of the Piedmont and in the Valley of Virginia, livestock raising and dairying have taken the place of crop farming as the main occupation of the people. Apple orchards make the Shenandoah Valley one of the great apple regions of the nation. Tobacco leads all other farm products in cash value, and the manufacture of cigarettes is one of the principal industries of the state. Smithfield hams, from peanut-fed hogs, are a famous Virginia specialty.

Fishing. The coastal waters are rich in shellfish and many kinds of fish. Virginia usually ranks sixth among the states in the value of its fisheries. Oysters, clams, crabs, and shrimps are plentiful.

Ships and Shipping. Hampton Roads, the passage between the James River estuary and the mouth of Chesapeake Bay, is one of the finest harbors on the Atlantic coast. Norfolk, Portsmouth, Hampton, and Newport News handle a tremendous tonnage of shipping each year. Shipbuilding is a large industry, and there are naval bases of first importance in the area.

Minning. Bituminous coal, mined in the southwestern part of the state, is the principal product of the mining industry. The coal industry employs about 80 per cent of the miners in Virginia and accounts for nearly 75 per cent of the value of all minerals. Much of the coal is carried by rail to the seaports at the mouth of the James and then shipped by water to many markets. Among other minerals, the state has a variety of stones suitable for road building and general construction work.

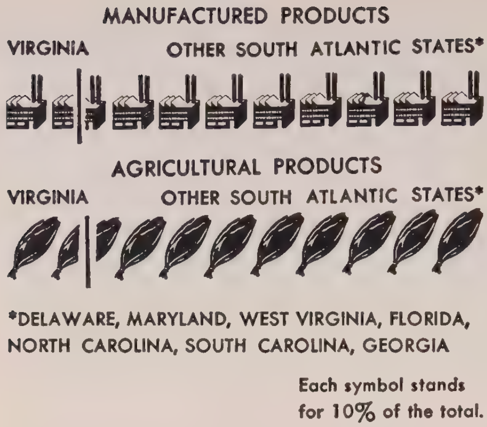


VIRGINIA'S GROWING SEASON is longest along the coast, shortest in the mountain region.

Manufacturing. Cigarettes account for more than one third of the annual value of Virginia manufactures. Richmond, the leading industrial city, is the center of the tobacco industry. Textile plants are scattered throughout the state. Virginia is a high-ranking state in the manufacture of rayon yarn and other synthetic yarns, cotton goods, and wool fabrics. Furniture factories account for more than one third of the total value of wood products. Chemicals, food products, paper, clothing, and shoes are also listed among the manufactures of the state.

Government. The governor, lieutenant governor, and attorney general are elected by popular vote for four-year terms. The legislature, or general assembly, consists of forty senators elected for four years and one hundred delegates who serve for two years. The assembly meets for sixty days in even-numbered years. Voters must be twenty-one years of age or older, must meet the requirements of literacy and of residence in the state and county, and must have paid the poll tax.

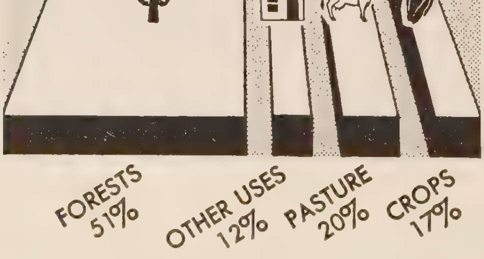
Education. A system of public schools, both elementary and secondary, was set up in Virginia in 1870, and in the twentieth century it was greatly expanded to meet the needs of the communities in the state. The number of high schools was increased from ten in 1910 to more than five hundred in 1950. Elementary schools number about 3,000, and there are several public institutions of higher learning. Children between the ages of seven



AMONG THE SOUTH ATLANTIC STATES Virginia ranks with the leaders in the value of both manufactures and agricultural products.

and sixteen must attend school. Separate schools are maintained for Negroes. The University of Virginia at Charlottesville; the College of William and Mary at Williamsburg; Virginia Polytechnic Institute at Blacksburg; Virginia Military Institute at Lexington; Virginia State College for Negroes at Petersburg; and several teachers colleges are all state-supported. Virginia has many private schools and colleges, among them Washington and Lee University at Lexington, the University of Richmond at Richmond, Randolph-Macon Woman's College at Lynchburg, Hampton Institute, a noted Negro College at Hampton, and Sweet Briar College at Sweet Briar.

Historic Places. In colonial Virginia many people lived on great estates, or plantations, where tobacco was grown as the important cash crop. The plantation owners were often well-to-do English aristocrats, and each plantation was a community in itself, with a church, a school, and homes for the workers. The owners built beautiful homes made of native brick and planted beautiful gardens along the banks of the James and the other rivers of the Tidewater. A number are still in existence. Some are national shrines, like Mount Vernon, Washington's home on the Potomac, and Monticello, the house Jefferson built on a hill overlooking Charlottesville and the University of Virginia. A few are still occupied by descendants of the original builders, but most have passed into other hands. In some cases foundations have been set up to care for houses of particular historic interest. Woodrow Wilson's birthplace in Staunton is maintained by such a foundation.



PRODUCTIVE FARM LAND and pastures cover more than a third of the total area of Virginia.

Williamsburg, the colonial capital of Virginia, was rebuilt and restored in the twentieth century. It attracts thousands of visitors each year. Richmond, which was the capital of the Confederacy during the War between the States, contains many buildings of special interest. Both the Revolutionary War and the War between the States ended on Virginia soil, the first at Yorktown and the second at Appomattox. Yorktown is part of the Colonial National Historical Park, which also includes the ruins of Jamestown; Appomattox Court House is a national monument; and the Lee Mansion in Arlington, where Robert E. Lee lived before the War between the States, is a national memorial. Shenandoah National Park is in a wonderfully scenic part of the Blue Ridge Mountains in northern Virginia.

History. Jamestown was founded in 1607 by a group of settlers sent out by the London Company. The first few years were extremely difficult, but the colony was saved in 1610 by the arrival of Lord Delaware with supplies and reinforcements.

John Rolfe, who married Pocahontas, daughter of Chief Powhatan, introduced the cultivation of tobacco, and prosperity began in the colony with the first shipments to England in 1619. By the end of the century the export crop amounted to 18,000,000 pounds. Also in 1619, the House of Burgesses, the first representative assembly in North America, was established to share the authority of the royal governor. The tyranny of one of the royal governors, Sir William Berkeley, led in 1676 to an uprising known as Bacon's Rebellion (see BACON'S REBELLION).

The first Negroes arrived in Virginia in 1619, but slavery was not introduced until 1653, when cheap labor was demanded by the tobacco growers. In 1776 there were more than 270,000 slaves in the colony. The eighteenth century in Virginia was marked by the development of the great plantations and the rise of a remarkable group of political leaders. Virginians took a prominent part in the French and Indian Wars, in the Revolution, and in the framing of the Constitution. Patrick Henry, Thomas Jefferson, George Washington, James Madison, and Peyton Randolph, first president of the Continental Congress, were all Virginians.

The War between the States proved disastrous. The leaders of Virginia decided on secession after some hesitation. Richmond was the capital of the Confederacy, Robert E. Lee commanded the Confederate armies, and other Virginians, such as "Stonewall" Jackson and J. E. B. Stuart, proved to be able generals. But Virginia was one of the chief battlegrounds of the war, and by the end of the fighting the state was devastated. More than one third of its territory was lost in 1863 when West Virginia broke away to become a separate state. Cities, farms, factories, and railroads were in ruins. Virginia was not readmitted to the Union until 1870.

During the twentieth century the state made strides in industrial development, in education, in social-welfare programs, and in government efficiency.

Notable Men and Women. The eight Presidents born in Virginia were Washington, Jefferson, Madison, Monroe, William Henry Harrison, John Tyler, Zachary Taylor, and Woodrow Wilson. Other famous Virginians were John Marshall, Chief Justice of the United States Supreme Court; Henry Clay; Stephen Austin; Sam Houston, first President of Texas; Meriwether Lewis and William Clark, explorers; Booker T. Washington, the great Negro educator; Edmund Ruffin, the father of soil chemistry in America; Matthew Fontaine Maury, the foremost oceanographer of his time; Cyrus McCormick, inventor of the reaper; and Dr. Walter Reed, conqueror of yellow fever. Among native authors to achieve eminence are Ellen Glasgow, James Branch Cabell, Willa Cather, Thomas Nelson Page, Mary Johnston, Blair Niles, and Douglas Southall Freeman.

Related Articles. Consult the following titles for additional information:

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Rappahannock River
Shenandoah River

HISTORY

Berkeley, Sir William
Bull Run, Battles of
Chancellorsville
Civil War
Fredericksburg
Jamestown
Petersburg, Siege of
Revolutionary War
Smith, John
Williamsburg

VIRGINIA, MINN., a town about fifty-five miles northwest of Duluth, is a distributing point for iron ores from the famous Vermilion and Mesabi ranges and a market center serving the mining and lumbering communities of the region. Two miles north is the Laurentian Highland Divide. From it

Total Area: 40,815 square miles, including 916 square miles of inland water.

Rank in Size: Thirty-fifth.

Population (1950): 3,318,680.

Rank in Population: Fifteenth.

Density of Population: 83.1 persons per square mile.

Chief Cities: Richmond (capital, 230,310), Norfolk (213,513), Roanoke (91,921), Portsmouth (80,039), Alexandria (61,738), Lynchburg (47,727), Newport News (42,358).

How Acquired: One of the thirteen original states.

Date of Admission to Union: 1787.

Nickname: Old Dominion.

Flower: Dogwood.

Bird: Cardinal.

Song: "Carry Me Back To Old Virginny," by James Bland.

Motto: *Sic Semper Tyrannis* (Thus ever to tyrants).

Seal: On one side Virtue stands triumphant over Tyranny. The state motto is below, the state name above. On the other side is Liberty, with Plenty and Eternity. The word *Perseverando* is above the figures.

Flag: Blue. In the center is the coat of arms with the figures of Virtue and Tyranny from the state seal.

Noted for: Historic spots (Jamestown, Monticello, Mount Vernon, Arlington, Williamsburg, Yorktown). Scenic beauty (Blue Ridge Mountains, Natural Bridge, Luray Caverns, Shenandoah Valley, beach resorts). Agricultural products (tobacco, peanuts, livestock, apples, corn, garden crops); manufactures (rayon yarns, textiles, furniture, chemicals, ships, processed foods).

all waters of the area flow north and south.

The town was settled in 1892 and became a city in 1905. Twice burned by forest fires, the city has ordained that all buildings in its central part be constructed of non-inflammable material. The population is about 13,000.

VIRGINIA, University of, a state institution of higher learning, located near Charlottesville, four miles from Monticello, the old home of Thomas Jefferson. The university was founded by the state of Virginia through the influence of Jefferson, in 1819, and it owes much of its efficiency to his interest and care. In October, 1903, the government board created the office of president, prior to which time the executive officer of the university was called rector. The institution is organized into academic, engineering, law and medical departments. There are over 400 instructors and about 3,000 students. The library contains nearly 339,000 volumes; the endowment is approximately $12,000,000. The state of Virginia makes an annual appropriation for the maintenance of the university. Among the interesting buildings is the Rotunda, modeled upon the Pantheon at Rome; it formerly housed the library.

VIRGINIA CITY, Nev., an unincorporated town, the county seat of Storey County, twenty-three miles southeast of Reno and served by the Virginia & Truckee Railroad. It came into existence with the discovery in 1859 of the famous Comstock lode, the world's richest silver and gold mine, which subsequently had a consolidated output of approximately a billion dollars. In 1864 the city was incorporated. First known as Ophir and later as Silver City, it received its present name from an early settler who was familiarly known as "Old Virginia." In 1880 it had a population of 10,917, its decline after that date being largely due to exhaustion of the lode and a decline in the price of silver. Population, about 800.

VIRGINIA CREEPER, a shrubby, hardy climbing plant of the grape family. It is much grown on walls on the continent of Europe, in the British Isles and in America as an ornamental vine. The stem develops tiny rootlets along its entire length, and by means of these the vines, which often attain a great size and weight are upheld. The foliage is compound, five leaflets to a stem, and in autumn is brilliantly colored. The wild Virginia creeper is sometimes mistaken for poison ivy, though the latter has three leaflets on a stem. Because of the little bunches of dark blue berries which appear in the fall the creeper is sometimes called *false grape.*

VIRGINIA RESOLUTIONS. See Kentucky and Virginia Resolutions.

VIRGO, *vur'go* (the virgin), the sixth sign of the zodiac, represented by the sign ♍. The principal star of this constellation is Spica, one of the lesser first-magnitude stars. The sun enters the constellation of Virgo about August 20th.

VI'RUS is the name given to certain tiny organisms that cause disease in plants and animals. Viruses can grow and reproduce only when they are inside living cells. They are much smaller than bacteria and can be seen only with an electron miscroscope. Viruses cause such diseases of man as the common cold, influenza, virus pneumonia, measles, poliomyelitis, and smallpox. In animals they produce rabies, hog cholera, and fowl pox. Tobacco mosaic is a virus disease of plants. See Disease; Diseases of Animals; Diseases of Plants.

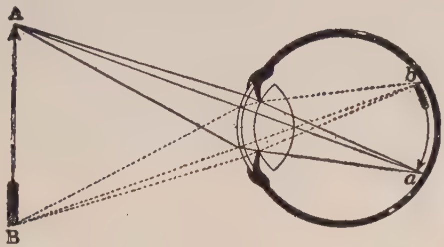
VISCOUNT, *vi'kount,* originally, in English usage, the officer who acted as deputy to a count or earl. As a hereditary title, it was first granted to John Beaumont, in 1440. A viscount is "Right Honorable" and is styled "My Lord." His wife is a *viscountess,* and his children are addressed as "Honorable."

VISH'NU, the second of the three great Hindu gods, by his special worshipers considered to be the greatest. In the early Vedas he was not regarded as the most exalted deity, but this rank was accorded to him by the later writers. The myths relating to Vishnu are characterized by the idea that whenever a great physical or moral disorder affected the world, Vishnu descended to set it right. He is generally represented as having four hands, in which he holds a conch-shell, blown in battle; a disk, the symbol of supreme power; a mace, the emblem of punishment, and a lotus, the sign of the creative power. Often he is shown as riding on a being, half man and half bird. See Brahma; Siva.

VISIBLE SPEECH, a term applied by Prof. A. Melville Bell, its inventor, to a system of aphabetical characters, designed to represent every possible articulate utterance of the organs of speech. The system is based or an exhaustive classification of the possible actions of the speech organs, each organ and every mode of action having its appropriate symbol. It is said that this invention is of great utility in teaching the deaf and dumb to comprehend spoken words and in aiding students of foreign languages to acquire their pronunciation from books.

VISIGOTHS, *viz' e goths.* See GOTHS.

VISION, *vizh' un*, or **SIGHT**, the act of perceiving objects through the eye. As an optical instrument, the eye closely resembles a camera, the cornea and crystalline lens corresponding to the lens of a camera, and the retina corresponding to the screen. The rods and cones of the retina are sensitive only to the light, and their great number and variety enables the perfect eye to respond to light waves producing all colors. Rays of light entering the eye through the pupil are refracted, and they cross just back of the lens, the rays from *A* coming to a focus on the retina at *a*, and those at *B* coming to a focus at *b*, thus forming an inverted image on the retina. This may be observed by carefully cutting away the sclerotic coat from around the optic nerve of an eye taken from one of the lower animals, exposing the retina over an area about the size of a dime, and holding the eye towards a lighted lamp in a darkened room. An image of the lamp inverted on the retina can be plainly seen.



Physiology of Vision. Though the image may fall on the retina of a dead eye, there can be no vision in such case, as vision must depend upon the action of the living optic nerve.

The sensory fibers of the optic nerve originate in the optic centers of the brain. These fibers meet and cross at the base of the brain, forming the *optic commissure*, from which the optic nerves extend to each eye. In the commissure, half of the fibers cross, so that each optic nerve consists of half of the fibers from its own optic center and half of the fibers from the optic center on the opposite side of the brain. On reaching the eye, these fibers are so distributed that those from the right optic center form the right half of the retina in each eye, and those from the left center form the left half. When the rods and cones are stimulated, impulses are transmitted along the optic nerves and optic tracks to the centers of unconscious sight in the brain. From these centers, other nerves extend to the centers of vision, and when the stimuli are strong enough to cause impulses to be transmitted to these centers, the person becomes conscious of them and sees the object. This is completed vision, and the image is retained in memory for a greater or less length of time, depending upon the strength of the stimuli and mental condition at the time the vision occurs. Consciousness and memory are mental activities, so that complete, intelligent vision depends upon mental, as well as physical action.

Related Articles. Consult the following titles for additional information:

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Memory

VITAMINS, *vi' ta minz*, essential elements in food. Until the twentieth century, these elements were unrecognized, and much remains to be discovered about them. Having no direct food values in themselves, they are necessary to nutrition; unless the proper vitamins are present in the required amounts, the diet will not promote health and well-being. Absence or serious lack of any of the vitamins may lead to a so-called "deficiency disease."

Vitamin requirements vary according to the age, size, health and occupation of the individual. Vitamins are not cures, but rather preventives; they are indispensable to health, as they affect vitally every organ in the body and their lack may cause or contribute to diseases and even deformities.

More vitamins have been discovered than were originally thought to exist, resulting in temporary confusion. Most of them are referred to by alphabetical names for convenience. From time to time, new discoveries of vitamins are reported. The following are the chief known ones.

Vitamin A is essential for normal growth, good tooth and bone formation in children, and for healthy skin and good eyesight. Usually, Vitamin A will prevent or relieve night blindness, unless it is too far advanced. It aids in preventing infections, especially in the respiratory tract, kidneys and bladder. It is found in the liver and yellow body fat of most animals, in cod-liver oil, butter, cheese, eggs, milk, green and green leafy vegetables such as green beans and spinach, and in yellow fruits and vegetables such as apricots and carrots.

Vitamin B was originally thought to be a single element, but has been proved to be instead a complex containing a group. It includes the former Vitamins F (now B_1) and G (now B_2). Of the group, B_1, B_2 and B_6 are the most important.

B_1, or thiamin, is the preventive of beriberi, a deficiency disease, and can correct certain forms of it. It is also of aid in treating certain forms of neuritis. A lack of B_1 results in a retardation of growth of children. It is present in seeds but not in highly refined cereal products, such as polished rice. Yeast and wheat germ are richest in B_1, which occurs also in whole-grain cereals and flours, in pork, fresh ham, liver, soy beans, green peas, nuts, egg yolk and lima beans.

B_2, or riboflavin, is essential for normal nutrition; its lack results in lesions around the mouth, and on the tongue and ears. It is so widely distributed that there should never be a lack of it. Important sources are yeast, liver (beef, calf, lamb, pork), whole cereals, milk, eggs, cheese, many green leafy vegetables, fruits, peanuts, and fish such as halibut, haddock, canned sardines and mackerel.

Nicotinic acid (renamed niacin) is the pellagra-preventive factor of the B complex. Even acute cases of pellagra respond with astonishing rapidity to this vitamin. Liver, lean meats, salmon, yeast, green vegetables, whole grains, tomato juice, eggs and milk are good sources of niacin, which can also be produced in pure chemical form and thus given directly to the pellagra victim.

Vitamin C is ascorbic and can be chemically produced. Deficiency in this vitamin results in scurvy, which may be avoided or cured by a rich Vitamin C diet. Vitamin C aids in normal development of bones, cartilages, teeth and gums. It exists widely in almost all raw fruits and vegetables, but especially in citrus fruits, green salad leaves and shoots, tomatoes, raw vegetables such as brussels sprouts and golden bantam corn, and baked potatoes or potatoes boiled in their skins. Vitamin C deteriorates in most foods canned or stored; they should be eaten while fresh.

Vitamin D aids in bone development, and prevents rickets and bone deformities. It is necessary for the body to utilize properly the calcium and phosphorus essential to growth. It has been produced in crystalline form. Few foods contain much of it. The best source is fish liver, such as halibut, tuna and cod. It also is present in canned salmon, sardines, eggs and butter, and in small amounts in liver, cream, milk and oysters. However, when the skin is exposed to the sun or to ultraviolet rays, Vitamin D is formed in the body.

Vitamin E is little known, but it has proved to be essential to normal reproduction in animals, although its relation to the human body is not yet clearly defined. The richest sources include wheat-germ oil, seeds of legumes, muscle meats, egg yolk, milk and milk products. It is, however, so widely distributed among common foods and so difficult to destroy that it is believed any ordinary diet will contain a sufficient amount of it.

Vitamin K is the coagulation factor, essential in enabling the blood to clot, and therefore a preventive of hemorrhage. It has not been proved of value in treating hemophilia (hereditary bleeding), but is useful in surgery where certain types of blood coagulate too slowly for safety. It is widely distributed, occurring especially in green leafy vegetables and in hog liver. Deficiencies in this vitamin come usually from faulty absorption rather than improper diet.

Enriched Foods. It has been found possible to "enrich" or "fortify" certain foods with additional vitamins. Milk, one of the most valuable foods, is frequently sold with added Vitamin D, either put into the milk in concentrated form or by means of ultraviolet rays (called irradiated milk), or by feeding the cows feeds which are rich in Vitamin D. The term "enriched" is used particularly for flour and bread. Enriched flour is white or nearly so, and contains specified amounts of Vitamin B_1, B_2, niacin and iron, with sometimes certain amounts of Vitamin D and calcium. Sometimes certain methods of milling insure the retention of those valuable elements in the discarded coarse outer portions of the grains; more often the vitamins and minerals are added to plain white flour. Enriched bread is made from such flour; or from plain white flour leavened with yeast enriched with those elements; or by adding the vitamins and minerals directly to the mixture. Oleomargarine is often sold with added Vitamin A, in which butter is naturally rich.

Vitamin Concentrates may be secured in tablet or capsule form. The average individual, however, can secure an adequate supply of vitamins from an ordinary diet and does not need such concentrates, which should be taken only on advice of a physician.

Conservation of Vitamins. Vitamins C, B_1, B_2 and niacin dissolve readily in water. Thus, when foods are cooked, considerable vitamin value is lost unless the water is used to make gravies or soups. Vitamin A is lost and C deteriorates in food storage or wilting of vegetables, while C escapes more quickly if fresh fruits and vegetables are bruised, peeled, cut or chopped. Slow drying causes loss of Vitamins A and C. Thus, fruits and vegetables should be secured as fresh as possible and served as quickly as possible. Very little water should be used in cooking, and long cooking processes such as stewing should be avoided. Food canned properly compares favorably with fresh food. The quick-freezing process retains all the vitamins and nutritional values.

In Wartime. Vitamins are essential in wartime, to keep the health of the soldiers and to guard against disease caused by change of climate and lack of fresh foods; to keep the health of civilians working long hours under the strain of war conditions; and to guard against "war nerves" for men in service and civilians alike.

VITAL STATISTICS. See POPULATION, subhead *Vital Statistics.*

VIT'RIOL, OIL OF, the common name given to strong sulphuric acid. See SULPHURIC ACID.

VIVISECTION, *viv i sek' shun,* physiological investigation on living animals for the purpose of discovering or demonstrating some fact of physiology. The term, which literally means *the cutting of the living,* was formerly employed to designate only cutting operations upon living animals for purposes of experiment. Today it has a broader application and includes inoculation with disease germs, experimentation with drugs, medicines and foods and with the effects of temperature upon living organisms, as well as cutting operations involving nerves, arteries and vital organs.

Vivisection has been generally regarded as the necessary means of acquiring physiological knowledge. Practically our entire knowledge of bacteriology and of the effects of drugs and medicines has been gained through this method of investigation, and nearly every operation and appliance to relieve pain or save life has been made possible through it.

VIZIER, *vi zeer',* a high official in Mohammedan countries, particularly the Prime Minister to the sultan, known as the grand vizier and possessing powers second only to the ruler himself.

VLADIVOSTOK, *vlah dye vohs tohk',* SIBERIA, the chief commercial and naval port of the country on the Pacific, the eastern terminus of the Trans-Siberian Railway. The city lies at the southern end of a peninsula, on an arm of the Sea of Japan. It has a fine harbor, ice-free nine months of the year, and is connected by steamship lines with Japanese, Korean, North Siberian and North American ports. The city is impressive in appearance when viewed from the magnificent bay, but on closer inspection is disappointing. During the two World Wars, it was an Allied base and port of entry to Russia. The city declined in the period following the First World War. Later, Soviet Russia's economic development of its Eastern regions and Japan's military activity in Northern China gave it renewed importance. It was especially important to Russia in World War II. Population, about 266,000. See SIBERIA.

VOCA'TIONAL EDUCATION, that type of education designed to prepare young people for their life work. Vocational education trains in the skills and social understanding necessary for a specific occupation; vocational guidance helps the individual choose his occupation. Since the beginning of the present century, vocational education has made rapid progress.

When the United States entered World War I in 1917, the government at once discovered the dearth of skilled workmen. Especially was there a scarcity of mechanics, carpenters and shipbuilders, and to supply the demand, the government entered upon a campaign of industrial training on a scale never before undertaken. The progress in vocational education in the two years following the declaration of war exceeded that during the ten years preceding that date.

The development of techniques and subject matter in the period that followed and the almost doubling of the number of pupils finishing grade school confirm the government's earlier contention—that, if the course of study could be changed so as to relate it more vitally to the occupations of life, most of these pupils could be retained in school. Under the leadership of the United States Bureau of Education, the leading educators made such revisions of the courses of study as enabled them to provide more liberally for vocational subjects and vocational guidance.

Vocational Guidance precedes and accompanies vocational education, as it provides the individual with the knowledge and experience necessary to best choose his life work. The increasing complexity and specialization in business, professional life and industry require assistance beyond what the parents can give in the home. Within the school system, the individual and the occupation can be studied, group and individual counseling given, and classes conducted with supplementary aids. Counselors aid in final placement. Often, the school coöperates with local business and employment offices toward the occupational adjustment of out-of-school youth, extending its influence even after graduation. A good vocational library is a decided asset, and, frequently, students can make visits to learn more about desired life works and careers. In some schools, actual experience is given through a system of free hours for employment during school hours, permitting youth to try out his chosen career and know whether he will be a misfit or whether he can handle the work and will find it enjoyable.

Vocational Schools. About eighty-five per cent of the pupils trained in the public schools earn their living through industrial processes, and vocational schools are designed to fit young people for useful occupations.

Vocational schools are elementary in character, but they do not receive pupils under fourteen years of age. The courses are usually two years in length; a few schools have three-year courses. In most of the schools the time is about equally divided between book-work and shop-work. The school work includes English, mechanical drawing, mathematics and other closely related subjects. Many evening schools are largely vocational.

Technical High Schools. Technical high schools have become a feature in the school systems of most large cities. Such schools aim to prepare trained workers for the industrial world. Cleveland and Chicago took the lead in introducing industrial courses in high school work, and these and other cities have such special schools.

The textile industry in the United States supports a number of schools which are closely allied to the high schools. Prominent among these are the Textile School of the Pennsylvania Museum at Philadelphia, and three schools in Massachusetts, at Fall River, New Bedford and Lowell, all three cities being great cloth manufacturing centers. Secondary schools, such as the Illinois Institute of Technology at Chicago, the Drexel Institute at Philadelphia and the Pratt Institute at Brooklyn, now offer similar courses.

Trade Schools. Trade schools have been developed to take the place of the apprenticeship system. The first important one in the United States, the New York Trade School, was founded in 1881, and was intended primarily for the mechanics in the building trades. A number of other important schools were established in the next thirty years, but not until 1910 was there a notable increase in the number of trade schools. Many of the schools, like the Baron de Hirsch School in New York, are privately endowed. In Chicago, Milwaukee, Philadelphia, Indianapolis, Worcester and Portland, Oregon, are trade schools supported wholly or in part by the municipality.

United States Aid. The most important factor in promoting vocational education in the United States is the Smith-Hughes Act, which became effective in February, 1917. This law is explained under HIGH SCHOOL (which see). The passage of this bill, for which the National Society for the Promotion of Industrial Education had labored for ten years, marked the beginning of a new educational policy, in granting Federal aid to schools below collegiate grade which are not state institutions. This act supplements the Morrill Act, which provided for the state agricultural colleges and experiment stations, and it makes provision for the training of a large group of the population that cannot be reached directly by the Federal government. The provision of the act requiring the state governments to coöperate with the Federal government in order to derive any benefit from the appropriation places vocational education on a permanent basis in every state.

Aid to Soldiers. In June, 1918, Congress passed a law providing for the vocational education of disabled soldiers and sailors on their return to civil life. The responsibility for this training is placed with the Federal Board of Vocational Education, and the plan provided for the co-operation of the War and Navy departments, the Bureau of War Risk Insurance and the labor exchanges in the Department of Labor. The scope of the work included completion of the training for such occupation as the soldier might choose and placing him in industry.

Even before the United States entered World War II, vocational education was fitted into the defense program for soldiers and civilians alike. The government encouraged an increase of vocational courses in schools with special emphasis on defense work and training needed for service. Defense courses sprang up everywhere during evening hours and on Saturday afternoons, for adults as well as youth. Such courses, both in and out of school, aimed to give training in actual defense services and also to train youth and adults to take the place of men gone into the service. Many openings were thus created and there was a lack of skilled workmen to fill them. This gave an opportunity for youth to choose and for adults to shift from one vocational field to another.

In 1944, near the close of World War II, Congress passed the Servicemen's Readjustment Act, or G. I. Bill of Rights, which enabled disabled veterans to take vocational and educational courses in schools and colleges. See G. I. BILL OF RIGHTS.

VOD'KA, an alcoholic liquor distilled from corn, rye, or potatoes, or from barley mixed with potatoes and oats, or from potatoes and molasses. It is "hard liquor" of a most potent sort, for its natural alcoholic content varies from 60 to 90 per cent; before it is retailed the amount of alcohol is reduced by dilution to about 40 per cent. Vodka was long the national alcoholic drink of the Russian people. During World War I the czar prohibited its manufacture; in 1925 the Soviet government restored its sale as a state monopoly, and from it derived a very large revenue.

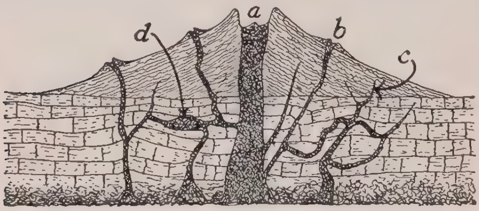
VOICE, *vois,* sound emitted by the vocal cords of persons and animals, by means of which they communicate to one another their thoughts or emotions. The organ of the voice is the larynx, a cartilaginous box at the top of the trachea, or windpipe, capable of more delicate adjustment than any musical instrument. Across its top are stretched highly-sensitive and delicate mucous membranes, the edges of which are specialized to form the vocal cords. Sound is produced by a blast of air forced from the lungs upward through the glottis, or opening between the cords.

The pitch of the voice depends upon the tension of the vocal cords; the greater the tension, the higher the note produced. During the emission of acute sounds, the glottis contracts to a mere line. A deep rumbling sound is made by relaxed cords. The strength or loudness of the voice depends on the energy of the expiratory blast. Its quality depends upon the form and thickness of the cords, and is modified by the varying position of tongue, teeth and lips.

In the speaking voice, the notes have nearly all the same pitch, variety being mainly achieved through articulation in the mouth. The musical voice makes use of a larger number of notes, and their vibrations correspond to the notes of the musical scale. In singing, the vocal cords are under greater tension than in speaking. The principal difference between male and female voices lies in their pitch. The female vocal cords are shorter than those of the male, therefore their pitch is correspondingly higher. The male singing voice is classed as tenor, or bass, according to quality, and the female as soprano or contralto. The combined range of both covers about four octaves. A boy's voice is alto or soprano, because the vocal cords are no longer than those of the female. Change of voice in the adolescent boy, when the voice cracks or breaks, is due to rapid change in the larynx and temporary imperfect muscular control. See LARYNX.

VO' LAPUK, an artificial language invented by Johann Martin Schleyer, a German priest, and published by him in 1879. It was intended for use as an international language, but the hope of its friends has never been realized. Volapük is extremely simple and regular in construction, and the orthography is entirely phonetic, the words being pronounced as they are written. The root words are derived from all the languages of Europe. Volapük at first attracted many students, and international congresses were held in 1884, 1887 and 1889. Disagreements among its adherents regarding reforms in the language retarded the movement and ultimately led to the development of new and rival systems. See ESPERANTO.

VOLCANO, *vol ka'no,* a mountain that has one or more openings through which heated matter is thrown from the interior. The parts of a volcano are shown in the illustration below. The base comprises the walls and often blends with the cone so completely that no line of separation can be discovered. The term *cone* is usually applied to the upper and more recently formed portion of the volcano. In its summit is the opening called the *crater*. Leading from the crater down into the interior of the mountain is the *vent*, or *chimney*.



VOLCANO

(a) Crater; (b) Extinct crater; (c) Crevice; (d) Steam cavity.

The form of the volcano depends quite largely upon the material thrown out. If this is ashes or thick viscid lava, that does not flow rapidly, the slopes of the mountain are steep and may be quite regular, as in the case of Vesuvius, Etna and many of the volcanoes of the Andes. If the material is of molten lava, that flows freely, a low, flat mountain, with gentle slopes, is formed. The volcanoes of Hawaii are the best illustrations of this type. In these volcanoes the flow of lava seldom takes place through an opening at the summit, but an outlet is forced through one or more crevices in the sides of the mountain. The crater is large and shallow and contains numerous vents, surrounded by small cones. Between these may also be found pools of molten lava.

In size, volcanoes vary from low mountains, comparatively small, like those in the vicinity of the Mediterranean, to great peaks, whose summits are from 17,000 to 20,000 feet above the sea, as is seen in the volcanoes of the Andes and the highest peaks of the Rocky Mountains, which are extinct volcanoes.

Volcanoes are classified as active, dormant and extinct. *Active* volcanoes are those either in continuous or frequent action. *Dormant* volcanoes are those which are active only at long intervals, and *extinct* volcanoes are those which have ceased action altogether. There is, however, no absolute division, as a volcano may pass from one class into another without warning, that is, a dormant or extinct volcano may become active, and an active volcano may become extinct.

Eruptions. The nature of the eruption is determined by the character of the material thrown out, and its violence is usually proportional to the length of time the mountain has been quiet. Volcanoes accustomed to throw out molten lava seldom eject ashes in large quantities. At the beginning, the lava flows rapidly, but as it cools it crusts over and flows more and more slowly until its motion ceases. The flow destroys everything in the path of the fiery stream, and the eruption often causes great devastation, suffering and loss of life. Some eruptions are characterized only by solid matter and steam. The solid matter is in the form of masses of rock, gravel, sand and dust, or ashes. These rise to a great height and are often carried through the atmosphere for many miles.

The causes of volcanic action are not well understood; but the chief cause is generally believed to be the contact of water with highly heated portions of the earth's interior. The violence of the action is supposed to be due to the expansive force of steam that has suddenly been released from great pressure. The steam forces out the ashes. The flow of lava is probably caused by its being squeezed into the fissure by the movements of the earth's crust. Some geologists believe that there are lakes of molten rock in various places in the interior of the earth, and that these are subject to tides like those on the ocean. They reason that the increased pressure caused by these tides may now and then force an opening in the earth's crust through which the heated matter is thrown out. An eruption is usually preceded by an increase in temperature of the land at the base and on the sides of the mountain, the drying up of springs and wells and frequently by local earthquakes. The most disastrous eruptions, as affecting loss of life, were the eruption of Vesuvius, A. D. 79; Krakatoa, in 1883, and Mont Pelee, on the island of Martinique, in 1902. At this eruption over thirty thousand people lost their lives within a few hours. The eruption of Mount Etna in 1911 was also very disastrous.

Related Articles. Consult the following titles for additional information:

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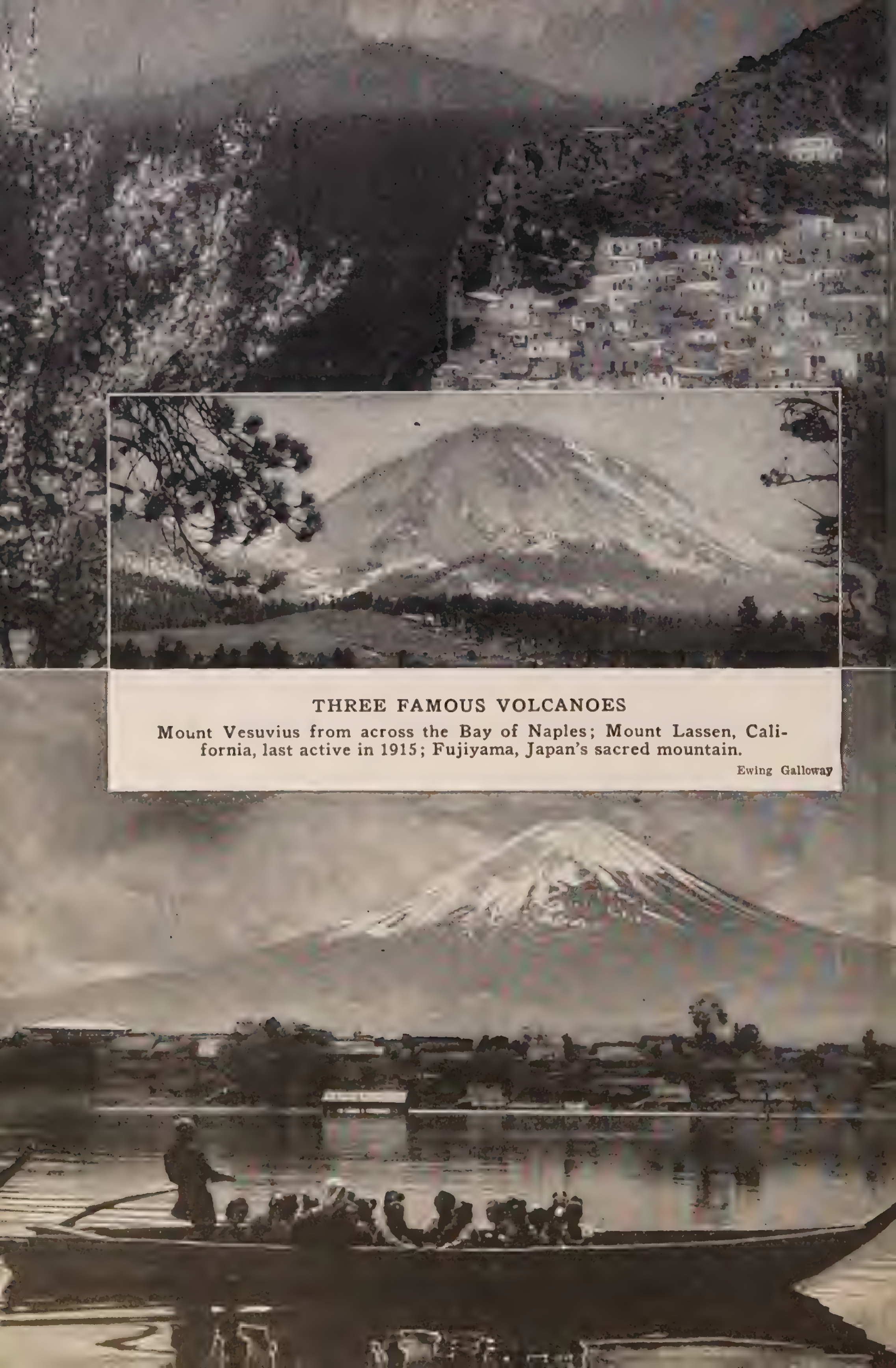
Mauna Kea
Mauna Loa
Mountain
Pompeii
Popocatepetl
Rainier, Mount
Vesuvius

VOLCANOES

Three of Java's many volcanoes. Cross section shows how subterranean forces effect an outlet in the earth's crust to release molten rock, ashes and gas. **El Misti, a slumbering giant of Peru.**

1 3 Ewing Galloway; 2 Publishers Photo Service



THREE FAMOUS VOLCANOES

Mount Vesuvius from across the Bay of Naples; Mount Lassen, California, last active in 1915; Fujiyama, Japan's sacred mountain.

Ewing Galloway

VOLE, an English name applied to several species of the rat family. The voles are widely distributed, being found in Europe, Africa, Asia and in North and South America. The *water* vole is about the same size as the brown rat, and it is often called a rat. It has dark brown or black fur, a tail about half the length of the body, and very strong hind feet, with five rounded pads on the lower surfaces. It burrows by the banks of streams and feeds for the most part on vegetable food. The *field vole,* or *short-tailed field mouse,* is about the size of a common mouse, but the body is stouter and the tail shorter. It has brownish-gray fur; its hind feet have six pads. It lives in fields and woods, feeds on vegetable food, is very prolific and often does much damage to grain and other crops. The *bank vole* is like the field vole, but it has a rusty-colored back, larger ears and a longer tail.

FIELD VOLE

VOL′GA, a river of Russia, the largest in Europe. It rises near the Valdai Hills, in the northwestern part of Russia, and flows in a circuitous course eastward and then southward, entering the Caspian Sea through a broad delta, a few miles below Astrakhan. The length of the river is about 2,200 miles, and it is navigable for nearly its entire course. The chief tributaries from the north and east are the Oka, the Sura and the Sarpa, and from the west, the Tvertsa, the Mologa, the Sheksna, the Kostroma, the Vetluga, the Kama and the Samara. The width of the river varies from 420 feet to 700 feet and exceeds even 2,400 feet, at Nijni Novgorod. During the spring it sometimes overflows, when its width varies from one and one-fourth miles to three miles. By means of canals the Volga is connected with the Black, the Baltic and the White seas, and with other important navigable rivers, so that it constitutes one of the most important inland waterways of Europe. With its tributaries it traverses a region inhabited by 50,000,000 people.

VOLT, the unit employed in measuring electric pressure, such a pressure as will produce a flow of one ampere per second against a resistance of one ohm.

VOLTA, *vohl′ ta,* ALESSANDRO (1745–1827), an Italian scientist, famous for his researches and discoveries in physics and as the inventor of the voltaic battery, named after him. He was born at Como, Italy, where, in 1774, he became professor of physics in the Royal School. He previously made important investigations and discoveries in chemistry and physics, especially in electricity. In 1779 he became professor of physics in the University of Pavia, and remained there twenty-five years. He invented the electroscope, the electrical condenser, the voltaic pile and the voltaic cell, or battery. See ELECTRIC BATTERY.

VOLTA′IC CELL, or **VOLTAIC BATTERY.** See ELECTRIC BATTERY; ELECTRICITY, subhead *Voltaic Electricity.*

VOLTAIRE, *vol tair′,* the assumed name of JEAN FRANÇOIS MARIE AROUET (1694–1778), a French writer and philosopher, was born at Paris. His father, a notary, gave him the best education possible, and the young man was early recognized as a scholar. In 1718 a tragedy named *Oedipus* was brought out by him and was most enthusiastically received. He soon became a fashionable poet, and resided mainly at Paris, in the midst of the most brilliant society.

In 1726 he was imprisoned in the Bastille for having sent a challenge to the Chevalier Rohan, by whom he had been insulted, but he was liberated within a month and allowed to go to England. Here he resided till 1729, in friendship with some of the chief literary men of the day, and he acquired a knowledge of English literature. His *Henriade,* an epic celebrating the exploits of Henry IV of France, was completed and published by subscription in England, and was widely read throughout Europe, except in France, from which country it was excluded by the government because of its forceful presentation of the idea of religious toleration.

After his return to France, Voltaire lived chiefly at Paris till 1734. During this period he raised himself from very moderate circumstances to a condition of affluence by successful monetary speculations. From 1734 to 1749 he resided with Madame du Châtelet at Cirey, in Lorraine, and he produced many plays during this period. After the death of Madame du Châtelet, Voltaire accepted the oft-repeated invitations of Frederick the Great to live at his court, at Potsdam. Here he was received with great honor, but a series of disagreements with the king ended in Voltaire's retirement from the Prussian court in 1753. After some unsettled years he fixed his residence with his niece, Madame Denis, at Ferney, near the boundary of the Republic of Geneva, and here he received a constant succession of distinguished visitors and maintained a correspondence which included in its range most of the rulers and savants of Europe. In February, 1778, he returned to Paris, but died soon afterwards.

Voltaire's works embrace almost every branch of literature—poetry, the drama, romance, history, philosophy and even science. He produced no single literary masterpiece; his greatness lay in his power to discern fanaticism and superstition, and nearly all his works are strongly animated by a spirit of hostility to the priests and the religion they represented. He was one of the foremost of that band of writers whose revolt against conventions, openly and most forcefully expressed, was preparing the way for the French Revolution. It is the commonly accepted opinion that he was an atheist, but this has never been proved. Voltaire's literary fame chiefly rests on his philosophical novels, *Zadig, Candide, L'Ingénu;* his histories, *The Age of Louis XIV, The History of Charles XII*; his correspondence, and more than all, perhaps, on his poetical epistles, satires and occasional light poems, all of which exhibit wit, gaiety, vivacity and grace.

VOLT'METER, an instrument for measuring the pressure of an electric current. It consists of a permanent steel horseshoe magnet, with a piece of soft iron attached to each pole. Between the poles, a soft iron cylinder is suspended, so that it can rotate vertically. Around this cylinder is a light rectangular frame of copper, wound with a coil of insulated wire. Spiral springs are attached at each end of this frame, and a needle, which moves over a graduated dial, is attached to the upper end of the axis. When an electric current passes through the coil or wire, it causes the copper frame to turn upon its axis. The springs furnish an amount of resistance that must be overcome by the current, and the position of the needle on the dial indicates the pressure. Voltmeters are used with dynamo electric machines. See VOLT.

VOLUNTEERS', citizens who, of their own accord, offer the state their services in a military capacity. The oldest volunteer force in Great Britain is the Honorable Artillery Company of the city of London, which received its charter of incorporation from Henry VIII. Until the second year of the World War Great Britain depended upon a volunteer army to take care of territorial defense, and its volunteer forces in 1914 numbered over 251,000. Not until May, 1916, was conscription put in force in Great Britain. It was applied to England, Scotland and Wales, but not to Ireland, which, however, sent large numbers of volunteers to the front. Canada contributed a volunteer army of over 400,000, but adopted conscription in December, 1917. New Zealand, South Africa and Australia relied wholly on volunteering, and all contributed generously. In all of the other allied nations, as well as in the enemy countries, conscription had been a permanent policy before the war.

In the United States. The volunteers in American armies played an important part in all wars before America's entrance into the World War. Though conscription was resorted to in the Civil War, about 2,500,000 enrolled voluntarily on the Union side, and half as many on the Confederate. Volunteers and regulars made up the American army of the Spanish-American War. In the World War there were calls for volunteers in special branches of the service, and the state national guards were classed as volunteers, but the bulk of the great army that contributed so much to the defeat of Germany was made up of men enrolled through the selective draft. This was the first time that America ever enrolled all of its men under forty-six years of age for military service. Navies are usually recruited through volunteering, but this is a matter of custom and precedent. See CONSCRIPTION; WORLD WAR.

VOLUNTEERS OF AMERICA, a religious and philanthropic organization, formerly the American branch of the Salvation Army. In 1896 Ballington Booth, head of the Salvation Army in America, believing that the methods of his father, William Booth, were not perfectly suited to conditions in America, severed the connection of his branch which, thenceforth, has had an independent existence. The main purpose of the English and the American bodies, however, has remained the same.

The Volunteers are organized on a semi-military plan, and the officers bear military titles. They support various benevolent institutions. Lodging houses for destitute men and women and fresh-air camps for women and children are among their most important charities. A great quantity of Christian literature is distributed, and open-air religious services are conducted on the streets. A Volunteer Hospital was established in New York City, where needy cases are taken care of. The official organ of the society is *The Volunteers' Gazette,* published at its headquarters in New York. General Ballington Booth and his wife, Maud Ballington Booth, became joint commanders. See BOOTH (family); SALVATION ARMY.

VOM'ITING, the forcible expulsion of matter from the stomach, through the oesophagus, or gullet. It is not a disease in itself, but it is a symptom common to numerous diseases, or as an accompaniment of extreme nervous sensitiveness. The treatment of vomiting depends upon its cause and upon the disease, if any, which accompanies it. Lying down, the application of mustard to the pit of the stomach, or small doses of soda, ice, whiskey or coffee will sometimes relieve it. While sudden and violent vomiting in a healthy person is an indication of some poisonous substance in the stomach, frequently, vomiting is nature's method of relieving an overloaded stomach. See NAUSEA.

VORTICELLA, *vor te sel'lah,* or **BELL ANIMALCULE**, *an i mal'ku le,* a genus of Infusoria, or one-celled animals characterized by a bell-shaped body, the opening of which is surrounded by tiny hairs, or cilia. These cilia are kept in constant and rapid motion, whereby they draw in particles of food. At the opposite end of the body is a slender stem, by means of which the animal attaches itself to objects in the water, such as rocks or weeds. This stem also moves, with a spiral springlike motion, and may be drawn up into the body when the animal wishes to detach itself from its moorings and swim freely about.

VOSGES, *vohzh,* **MOUNTAINS**, a chain of mountains about 100 miles long, extending in a north-northeast direction along the frontiers of Alsace in France, their course being nearly parallel with that of the Rhine. They are separated from the Jura Mountains by the valley of the Doubs on the south. The Vosges are composed chiefly of granite and are covered with forests of pine and beech to a height of about 3,600 feet, beyond which their summits, which are rounded in forms, are grassy. The highest peak is Ballon de Guebwiller, 4,067 feet. These mountains contain considerable silver, copper, lead and coal and large quantities of rock salt. Some of the bitter fighting of World War I took place in the Vosges region.

VOTE. See ELECTION; BALLOT.

VOTING MACHINE, a device for automatically registering and counting votes, having the advantages of secrecy, simplicity, rapidity of registration and counting and the avoidance of duplication.

In most patterns of voting machines, the voter enters the booth, and not till all the curtains are closed will the machine register his vote. The names of the candidates are arranged in order, either by parties or alphabetically. The voter can either vote a straight ticket or can vote for individual candidates. In the former case, either by the use of a key or by means of a lever, he registers a vote and thus locks the mechanism, so that he cannot vote further, unless, by turning back the lever, he cancels his first vote. If he wishes to split the ticket, he turns a lever or key for one candidate for each office, and is prevented thereby from voting for any other candidate. As he leaves the booth, by opening the curtains or doors at the exit he sets the machine for the next voter. Each vote cast for each office or for a straight ticket is registered by a patent device on a slip of paper, so that as soon as the last vote is cast, the final returns are ready to be announced. Most states have authorized the use of voting machines at the option of the local authorities.

VOWEL, an open sound made by the voice in speaking, distinguished from the consonant sounds, which are made with the organs of speech more or less closed. Vowels may be sounded by themselves, but consonants can be pronounced only in combination with vowels. In English, the vowel sounds are represented by the letters, *a, e, i, o, u,* and sometimes *w* and *y.* Each really represents several sounds, as the a-sounds in the words *father, flask, hall, what, any, preface, final* and *abound.* Most other languages have vowel sounds which the English does not possess. A more detailed discussion of vowels may be found in the article ORTHOGRAPHY.

VUL′CAN, called by the Greeks Hephaestus, in classical mythology, the god who presided over fire and the working of metals, and who patronized handicraftsmen of every kind. He was the son of Jupiter and Juno; but, unlike the other gods, he was seriously lame. By some writers he was said to have been born lame, and for that reason he was believed to have been thrown by his mother from Olympus; but by others his lameness is attributed to his having been thrown from Olympus by Jupiter, for interfering in Juno's behalf in a quarrel between her and Jupiter.

VUL′CANIZING. See RUBBER AND RUBBER MANUFACTURE.

VUL′GATE, the Latin translation of the Bible, which has, in the Roman Catholic Church, official authority, and which the Council of Trent, in its fourth session, on May 27, 1546, declared "shall be held as authentic in all public lectures, disputations, sermons and expositions; and that no one shall presume to reject it under any pretense whatsoever." Even in the early period of the Church, a Latin translation of the Old Testament existed, made not from the Hebrew, but from the Septuagint. Saint Jerome found that this translation was not always accurate, and between A. D. 385 and 405 he made a new Latin translation from the Hebrew, with the aid of the best Greek translations. This at first met with the greatest opposition, as the Septuagint was regarded as an inspired translation, and any deviation from it was considered sacrilegious. Before his death Jerome had justified himself and proved the purity of his intentions, but it was not until the ninth century that his version came to be used throughout the Church and not until centuries later that it was authorized. The version now in use is the edition published by Clement VIII in 1592. See BIBLE.

VUL′TURE, the common name for a class of carrion-eating birds, characterized by necks destitute of feathers and by elongated beaks, with curved upper mandibles. Their talons are not relatively strong, and in tearing their prey they make more use of their beaks than of their claws. Vultures are usually of a cowardly disposition and will not attack live animals, unless the latter are seriously wounded or dying, as they feed almost entirely on decaying animal flesh. They fly high in the air and detect their prey from great distances. They are valuable scavengers in all warm and tropical countries. The California vulture has a long, flat, orange colored head and dull black plumage, with a grayish wing band. It builds a loose nest of sticks, in a hollow in a tree or cliff, and lays one round, greenish-white egg. The Egyptian species, called "Pharaoh's hen," is found in the countries bordering the Mediterranean. See CONDOR; TURKEY BUZZARD.

VULTURE

W, the twenty-third letter of the English alphabet. It is formed, as its name indicates, by doubling the *u* or *v*, and before it appeared as a separate character in English its sound was sometimes represented by *uu* or *vv*. At the end of words or syllables it is either silent, as in *low*, or it modifies the preceding vowel, as in *new, how*, having then the power of a vowel.

WABASH, *waw'bash*, Ind., the county seat of Wabash County, forty-two miles southwest of Fort Wayne, on the Wabash River and on the Wabash and the Cleveland, Cincinnati, Chicago & Saint Louis railroads. It is the center for a rich agricultural and stock-raising region, and manufactures mineral wool, mechanical rubber goods, wood products and wood-working machinery, paper products, and various metal products. Wabash was settled and incorporated in 1837, and was chartered as a city in 1866. It was one of the first cities in the world to be electrically lighted. Gene Stratton Porter, the novelist, was born here. The population is about 11,000.

WABASH RIVER, a river 550 miles in length, rising in the western part of Ohio, flowing northwestward, westward, then southward into the Ohio thirty miles below Evansville, Ind. It crosses Indiana, and in the latter part of its course forms a part of the boundary between Indiana and Illinois. It is navigable during high water as far as Lafayette, Ind., and at ordinary levels to Covington. Its chief tributary is the White River. Some of the principal towns on its banks are Wabash, Peru, Logansport, Lafayette, Covington, Terre Haute, and Vincennes.

WACHT AM RHEIN, Die ("The Watch on the Rhine"), a German patriotic song. The words were written by Max Schneckenburger in 1840, when the left bank of the Rhine seemed in danger of falling into the hands of France. The music, by Karl Wilhelm, was composed in 1854.

WA'CO, Tex., the county seat of McLennan County, ninety-seven miles south of Dallas, on the Brazos River and on the Missouri-Kansas-Texas, the Missouri Pacific, the Saint Louis Southwestern, and the Southern Pacific railroads. There is regular air service from the well-equipped municipal airport, Rich Field. Lake Waco, with a storage capacity of 30,000 acre feet, provides the city's water supply. Industrially, Waco ranks about sixth among Texas cities, producing cotton and textiles, sash and doors, furniture, cement, dairy products, machine-shop products, and other articles. It is also an important retail and wholesale trade center. Waco is the seat of Baylor University, the oldest institution of higher learning in Texas, and Paul Quinn College, for Negroes. A veterans' hospital and a state orphans' home are located here.

Waco derives its name from the Huaco Indians. It was laid out in 1849 and was incorporated the following year. It has adopted the city-manager-commission form of government. Population, about 85,000.

WADAI, *wah'di*, formerly a native state in the central part of Africa, annexed to the French Congo (now French Equatorial Africa) in 1903. The boundaries are indefinite, but the area is estimated at 170,000 square miles. The surface is mostly of a desert character, but there are oases scattered through the region, and in some sections there are fertile tracts covered with forests. The population, estimated at 2,000,000, is composed chiefly of Negroes and Arabs, who are Mohammedans. The capital, Abeshr, is connected with Bengeazi by caravan route.

WAGER, *wa'jur*, a bet, also something staked on any uncertain outcome of an issue, such as the result of a contest, or the inevitable alternative in events, such as elections and the weather. The one whose opinion proves to be correct receives what has been staked by both. In some countries the laws provide that all contracts or agreements, whether oral or in writing, depending on wagers are null and void, and money due thereon cannot be recovered in any court of law. A wager is therefore called a *debt of honor,* since it cannot be collected except through the good faith of the parties.

WAGES, *wa'jez.* In modern industry production requires land, capital and labor. The payment for land is *rent;* the payment for capital is *interest,* and the payment for labor is *wages.* The United States government applies the term to compensation computed on an hourly, daily, piecework or similar basis, and defines *salary* as that which is computed on a weekly, monthly, annual or comparable basis. Wages may be classified as *nominal* and *real.* Nominal wages are the wages expressed in money, or as an absolute quantity, as five dollars a day. Real wages denote the purchasing value of the money received. To illustrate: If the cost of living advances and a laborer's wage remains the same, his real wage is lowered. If a bricklayer who received five dollars a day during a certain year received the same wage in a later year when living costs were fifty per cent greater, his real wage then was only two-thirds of what it was in the first instance. To enable him to maintain his standards, his later wage would have to be increased to seven and one-half dollars.

Difference in Wages. In economics, labor is considered as a commodity, the same as land, building material or wheat; and one of the chief causes in fixing wages is the law of supply and demand, other conditions being equal. When there are more laborers than production requires, wages will be low; when laborers are scarce, producers bid for their services, and wages are high. Wages in some occupations are higher than in others because of the nature of the occupation. Permanency of occupation, for instance, is an important factor in fixing wages. One can afford to work for a lower wage at an occupation which furnishes employment the year round than at an occupation which furnishes employment only part of the time. Skilled labor commands higher wages than unskilled labor, and dangerous occupations higher than those not considered as dangerous.

Wages and Profit Sharing. Many large firms distribute periodically among their employes a certain per cent of their profits. From the viewpoint of economics, their share of profit should not be considered as wages, but from the practical viewpoint of both employer and employe it is considered as so much additional compensation, or so much increase of the laborer's share of production.

Influence of Labor Organizations. As early as 1792, skilled workmen in America united to protect themselves against attempts by employers to lower wages. Trade unions, which since about 1830 have exerted increasing influence, have often secured for their members higher wages than could have been possible without a powerful organization. The power of labor organizations, keeping pace with the growing industrialization of the country, gave them an ever-greater political influence, which has resulted in Federal legislation bearing on wages. The National Labor Relations Act (1935), for instance, established the policy of collective bargaining, by which employers and labor representatives in joint conference adopt trade agreements affecting wages and other problems. In 1955, leading American automobile manufacturers granted their employees a guaranteed annual wage, which protects workers from loss of income during enforced layoffs.

Related Articles. For additional information, consult the following articles:

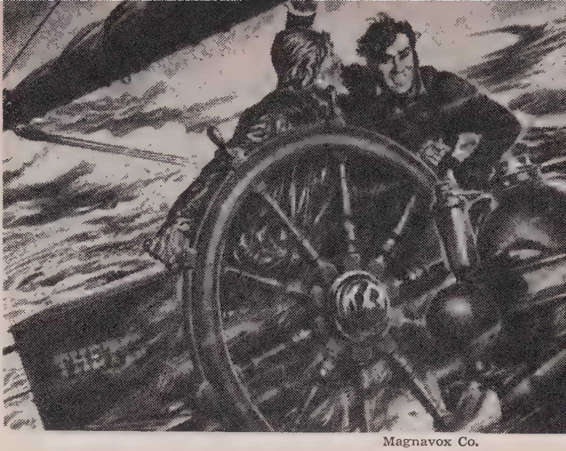
Capital
Inflation and Deflation
Labor, Division of
Labor Legislation
Labor Organizations
Labor Relations
Profit Sharing
Unemployment

WAGNER, *vagh'nur,* SIEGFRIED (1869–1930), a German operatic composer and orchestra leader, the son of Wilhelm Richard and Cosima Wagner. Beginning in 1893, he made several tours of Europe, presenting and interpreting his father's compositions. In 1896 he became co-director with his mother of the Bayreuth Wagner Festivals, and was general director of the playhouse after 1924.

WAGNER, WILHELM RICHARD (1813–1883), a German composer, poet and miscellaneous writer, born at Leipzig. He received his education at Leipzig and Dresden and after 1834 filled various musical engagements at Magdeburg, Riga and Königsberg. In 1839 he went to Paris and London and there composed his operas *Rienzi* and *The Flying Dutchman.* The brilliant success of the operas secured him the conductorship at the Royal Opera of Dresden in 1843. He joined the insurrectionary movement of 1848 and was compelled to exile himself. Until his return to Germany, in 1864, he spent most of his time in Switzerland, Italy, Paris and London. His *Tannhäuser* and *Lohengrin* appeared in 1845 and 1850, respectively. The king of Bavaria, Louis II, became an enthusiastic patron of Wagner, and the theater at Bayreuth, especially built for Wagner by the contributions of Wagner societies throughout the world, was chiefly supported from the king's purse. Here the famous tetralogy *Der Ring des Nibelungen,* consisting of *Das Rheingold, Die Walküre, Siegfried* and *Götterdämmerung* was first performed in 1876. About a year before his death Wagner wrote *Parsifal,* which has since been produced with emphatic success. He gave to his works a national character by selecting his subjects from old German legends. His theory, founded upon the ideas of Gluck and Weber, was that in a perfect musical drama, the three arts, poetry, music, and dramatic representation, should be welded together into one well-balanced whole. His particular views on music are embodied in a well-known work, entitled *Oper und Drama.* See OPERA.

WAG'TAIL, a group of birds so called from their habit of jerking their long tails when running or perching. Though several species are common in Europe, rarely is the bird seen in the United States. The wagtails frequent muddy lands and pastures, running rapidly along the edge of water and catching the insects they find there. A species of wagtail breeds on the coasts of Alaska in summer, making its nest of woven roots and grasses on or near the ground. The eggs are white with brown spots.

WAITE, MORRISON REMICK (1816-1888), an eminent American jurist, born at Lyme, Conn. He graduated at Yale in 1837 and was admitted to the bar two years later. He practiced successfully in Maumee City and Toledo, Ohio, was elected to the legislature and in 1871 was sent to Geneva as United States counsel in the Alabama case. President Grant appointed him to succeed Salmon P. Chase as Chief Justice of the Supreme Court of the United States in 1874. He held the position until his death, winning esteem for his impartiality and learning. Among the important questions presented to the Supreme Court and decided during Chief Justice Waite's term were those affecting polygamy, election laws, the civil rights of Negroes, the Bell telephone case, the power of removal by the President, and the Chicago anarchist cases.



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WAGNER'S "THE FLYING DUTCHMAN" was inspired by his stormy voyage from Germany to England aboard the small sailboat "Thetis." Tales of the sailors reminded him of the legend of the Dutch sea captain on which he based his opera.

WAKE, the name given to the custom of holding vigil over the dead during the night preceding burial. While it is a part of the practice of numerous religions, in America it is witnessed only among Roman Catholics. The wake originally was observed in the Church of England; it had nothing to do with death, but was observed with prayer and singing to commemorate the anniversary or consecration and dedication of the parish church.

WAKE ISLAND, a tiny coral island in the Pacific Ocean, which came into possession of the United States in 1899. It lies about 2,400 miles west and south of Hawaii and about 2,950 miles north and east of Manila in latitude 19° 15′ north, longitude 166° 38′ east. The island is not attractive and was not regularly inhabited until it was made a station in the transpacific air route. The government reorganization of 1934 placed Wake Island under the control of the Navy Department; it was used as a communications depot, and a small garrison of marines was stationed there. It was held by Japan from December, 1941 to September, 1945. See WORLD WAR II.

WAKE-ROBIN, another name for the trillium (which see).

WALDENSES, *wal den'seez,* a Christian sect founded in the twelfth century by Peter Waldo, a rich merchant of Lyons, France. About 1170 Waldo gave away his goods and his money to the poor and began preaching a life of poverty, chastity and obedience. While holding to the Roman Catholic faith, he believed the people should be preached to in their own dialects, that religious writings should be translated into their language, and that each man should be his own interpreter of the Bible. His followers, known as "the Poor Men of Lyons," suffered many persecutions, and in 1231 were excommunicated by the Pope. Their chief strongholds then as now were the Cottian Alps, southwest of Turin. Since 1848 they have had the same religious and political rights as other religious sects in Italy. Branches of the Church have been established in Argentina, Uruguay and the United States.

A typical costume

WALES, *waylz,* the smallest division of Great Britain, situated in the southwestern part of the island, forming a peninsula between Bristol Channel, on the south, and the Irish Sea, on the north. It has an area of 7,466 square miles, or a little less than that of New Jersey. Population, about 2,416,000. Its surface is mountainous in the north, where the ranges are an extension of those of England. The country is rich in minerals, particularly coal, iron, copper and slate, and to these Wales owes its chief wealth. The coal trade is the most important and extensive, and the city of Cardiff on the British Channel is one of the largest coal ports in the world. The presence of coal and iron ore has given rise to extensive iron and steel works, and there are also important copper plants. Other manufactures include woolen goods, especially flannel, coarse cloth and hosiery.

Previous to the Roman occupation, Wales appears to have been inhabited by a mixture of primitive Iberians and invading Celts. During the latter part of the Roman occupation one of the four provinces into which the entire island was divided included Wales and was called *Britannia Secunda.* After the invasion of the Saxons the country acquired a distinctly national character, becoming the refuge of the Celts, or early Britons, who were gradually driven to the west. The country was conquered in the thirteenth century by Edward I, who made his eldest son Prince of Wales, a title that usually has been conferred upon the heir to the British crown. Succeeding this date there occurred a number of national uprisings, and the struggle for independence in Wales was not entirely suppressed until 1536, when the country became incorporated with England and its inhabitants received all the privileges of English subjects. The language is Welsh, which is a branch of the Celtic, different from that used by the Irish and the Scotch Highlanders. The political and educational systems of Wales are identical with those of England. See CARDIFF; CELTS; ENGLAND; GREAT BRITAIN.

WALES, PRINCE OF, a British title borne by the eldest son of the British monarch. It was first conferred by Edward I on his son, at the time of his conquest of the principality of Wales. Edward III was never Prince of Wales, but the title has been conferred on nearly all the male heirs apparent to the throne from the time of Edward the Black Prince, son of Edward III. The title is not hereditary, but is purely honorary; it does not pass to the holder automatically, but must be conferred with appropriate ceremony. It implies no power or authority, and the accompanying income is voted by the British Parliament.

Descendants of Queen Victoria who bore the title were the princes who reigned as Edward VII (1901-10), George V (1910-36), and Edward VIII (1936). George VI (1936-52), brother of Edward VIII, who was unmarried while king, succeeded to the throne on Edward's abdication. He was Duke of York but never Prince of Wales. George VI left no sons, and was succeeded by his daughter, Elizabeth II. Her son, Prince Charles, was next in line for the title.

WALHALLA, *wahl hahl'a,* or **TEMPLE OF FAME**, a magnificent marble palace erected in 1830, near Ratisbon, Bavaria, by Ludwig I. The building, 115 by 246 feet in size, is in a style similar to Greek Doric. The pediments and frieze contain sculptures representing scenes from the early history of the Teutonic peoples, and inside are busts of noted Germans. The building is named for Walhalla, the mythological hall of the Norse deities.

WALKER, FRANCIS AMASA (1840-1897), an American economist and statistician, born at Boston, Mass., the son of Amasa Walker. He graduated at Amherst College and afterward studied law. He served in the Union army in the Civil War and was made brigadier general for gallantry at Chancellorsville, where he was wounded. From 1865 to 1867 he taught Latin and Greek at Williston Seminary, and in 1869 he was appointed chief of the bureau of statistics at Washington. As supervisor of the census of 1870, as United States Indian Commissioner in 1872 and (from 1873 to 1881) as professor of political economy in the Sheffield Scientific School of Yale College, he rendered distinguished service. In 1881 he became president of the Massachusetts Institute of Technology. He published many works, including volumes on the *Indian Question, Political Economy, The Wages Question, Money, International Bimetallism* and *The Making of the Nation.*

WALKER, William (1824–1860), an American adventurer, notorious as a leader of several filibustering expeditions. He was born at Nashville, Tenn., and was graduated at the University of Nashville. After a course in law he was admitted to the bar, and later he studied medicine at the universities of Edinburgh and Heidelberg. On his return to America he engaged in journalism.

In the summer of 1853 Walker organized an expedition to conquer the state of Sonora, Mex. Forced to flee from Mexico on account of a lack of provisions and ammunition, he was arrested by United States authorities at San Diego, and was tried for violating neutrality, but was acquitted. He then conducted expeditions in Nicaragua and Costa Rica, and each time was driven out. After several attempts to conquer Honduras, he was compelled to surrender to the Honduran government, was condemned by court martial and executed. See Filibuster.

WALKERVILLE, Ont., on the Canadian National, the Wabash, the Michigan Central and the Pere Marquette railways, one and one-half mile from Windsor, and directly across the river from Detroit. Steamship lines run to Fort William, Port Arthur, Montreal and intermediate points. The industries of the town are supplied by Niagara electric power; there are varnish and paint factories, wire fence works, bridge works, tobacco, clothing and chemical works, and manufactories of automobile bodies and trimmings, furnaces, castings and marine engines. It is now a part of Windsor city.

WALKING STICK, a name applied to a group of curiously-shaped insects, which closely resemble a small branch with twigs. In the southeastern part of the United States is found a typical species. The individuals have long, slender bodies and long, thin legs. They are green in summer, but turn brown in autumn; thus protected from detection they escape all but the closest scrutiny. The local names are *devil's horse* and *mule killer.* See Leaf Insects; Protective Coloration.

WALLACE, Alfred Russel (1823–1913), an English naturalist, born at Usk, Monmouthshire, and educated at Hertford Grammar School. While serving as English master at the Collegiate School of Leicester, Wallace became acquainted with Henry Walter Bates, the naturalist, and in 1848 the two departed on an exploring trip to the valley of the Amazon. This was the first of those scientific explorations that revealed to Wallace a wealth of new information in the field of plant and animal morphology. From 1854 to 1862 he was engaged in scientific study in the Malay Archipelago (which see). The material collected on these trips he embodied in *Travels on the Amazon and Rio Negro, The Malay Archipelago, Tropical Nature* and *The Geographical Distribution of Animals.* His observation of animal life and his philosophical nature led him to investigations which resulted in the formulation of a theory of natural selection and evolutionary development. Before Darwin gave his famous work to the world Wallace had published his *Speculation on the Origin of Species.* His share in establishing the theory of evolution has been acknowledged by Darwin. But while Darwin, in his later editions of the *Origin of Species,* somewhat modified his original conclusions, Wallace, in a late work, *Darwinism, an Exposition of the Theory of Natural Selection, with Some of its Applications,* strongly insists upon the complete controlling power of these primary laws and conditions. Moreover, he differs from Darwin on the subject of the intellectual, moral and spiritual nature of man. He contends that the higher faculties have been developed, not under the law of natural selection, but under a higher law, which has come in imperceptibly; and he maintains that the Darwinian theory, instead of opposing, "lends a decided support to a belief in the spiritual nature of man." His many essays entitle him to the claim of being a true Darwinian.

WALLACE, Edgar (1875–1932), an English newspaper man and novelist who issued his books with almost incredible rapidity. He was a war correspondent and special writer for London papers before turning exclusively to the more formal literary field. His novels, most of them mystery stories, were often written at the rate of one in ten days or two weeks, and in all they totalled more than 160. Though showing evidence of hurried composition, they found an immense sale in all English-speaking countries. Wallace was engaged to write for American moving-picture producers in 1931; in Hollywood, Calif., while engaged on scenarios, he died in the following year.

WALLACE, Lewis (1827–1905), an American soldier and novelist, generally known as Lew Wallace. He was born in Brooksville, Ind., received a common school education and began the study of law, which he practiced at intervals in Crawfordsville, Ind. He took part in the Mexican War, with rank of lieutenant, and was a member of the Indiana state legislature in 1848. At the outbreak of the Civil War he entered the service as colonel of an Indiana regiment, was appointed brigadier-general in 1861 and was made major-general for distinguished services at Fort Donelson in 1862. He was removed from command by Halleck, but was reinstated by Grant. He was sent to Mexico on secret diplomatic service in 1866, was elected governor of New Mexico in 1878 and was made minister to Turkey in 1881. His best-known works are *Ben Hur, The Fair God, The Prince of India* and *The Boyhood of Christ.*

WALLACE, William, Sir (about 1272–1305), the first of the great Scottish patriots, a man of herculean proportions and strength and possessing in a high degree those qualities of leadership which made his name famous. The king of England deposed the Scottish king in 1296 and placed over Scotland a guard of English soldiers. Wallace one day quarreled with and killed one of these soldiers, and escaped. He gathered a band of Highlanders and began a guerilla warfare on the English.

After collecting a considerable force, he was besieging the castle of Dundee when he heard that Surrey and Cressingham were advancing upon Stirling with a large army. He met them in the vicinity of that town and gained a complete victory (1297). After this Wallace gained the title of guardian of the kingdom and conducted a series of organized raids into England. In 1298 Edward I entered Scotland, and Wallace retired before him, wasting the country, but he was at length overtaken at Falkirk and was compelled to fight; after a gallant resistance, he was defeated. He succeeded in escaping, and little is known of his movements thenceforth. He was excluded from the peace granted by Edward to the Scots in 1304, and when he fell into the hands of the English he was conveyed to London and there executed as a traitor, though it was admitted that he had never sworn fealty to England.

WALLA WALLA, *wol'a wol'a,* Wash., commercial center of the southeastern part of the state, county seat of Walla Walla County, situated 159 miles southwest of Spokane on the Walla Walla River, and on the Northern Pacific and the Union Pacific railroads. There is regular air service at the municipal airport. The city is thirty miles east of the navigable Columbia River, and a hard-surfaced road, constructed from Walla Walla to Wallula, the nearest port, connects with boat lines. Walla Walla is located in a fertile valley which produces 5,000,000 bushels of wheat annually, besides extensive fruit, vegetables, livestock and dairy and poultry products. Whitman College, one of the oldest institutions of higher learning in the Northwest, and Walla Walla College are located here. The city has also the state prison and a veterans' hospital.

Walla Walla, a Nez Perce Indian term which means *many waters,* grew up about a military post which was established here in 1856; it was chartered as a town in 1859 under its present name, and was incorporated as a city in 1862. The commission form of government is in operation. The mission of Dr. Marcus Whitman was at Waiilatpu, six miles west of Walla Walla (see Whitman, Marcus). Population, about 24,000.

WALLENSTEIN, *vahl'en stine,* or **WALDSTEIN**, Albrecht Eusebius Wenzel von, Duke of Friedland, Sagan and Mecklenburg (1583–1634), a famous leader in the Thirty Years' War, born at Hermanic, in Bohemia, of poor but noble parentage. He was educated in a Jesuit College and at the universities of Padua, Altdorf and Bologna. Through a wealthy marriage he became prominent in affairs in Bohemia. For military service against Venice in 1617 he was made a count and commissioned a colonel. He took service in the Austrian army in the struggle against the Turks, and when the Thirty Years' War broke out in Bohemia (1618), he joined the imperial forces against his native country.

In September, 1630, owing to the jealousy of the nobles and the license of his followers, he was deprived of all command and retired to his duchy of Friedland, until the emperor was compelled to seek his aid against Gustavus Adolphus. Wallenstein then obtained almost absolute power, and his behavior thenceforth leaves no doubt that the emperor's interests were second to his own, and that he would not have hesitated to join the emperor's enemies, to secure his own independence and the crown of Bohemia. After some partial successes he encountered the king of Sweden at Lützen in 1632, and in the battle which took place Wallenstein was defeated and Gustavus was killed. Wallenstein had unsuccessfully treated on his own account with the Swedish king, and he now secretly reopened negotiations with France and the German princes, occasionally taking the field to display his military power. The court at Vienna was well aware of his double dealing, but the emperor was not strong enough to remove him, and he therefore had him assassinated. See THIRTY YEARS' WAR.

WALLFLOWER, a shrubby herb, belonging to the mustard family, native to Southern Europe, so called because it is often found growing among the stones of fallen walls. It thrives in dry soil and gravel and grows well on stony cliffs. The flowers in the wild state are invariably yellow; under cultivation they exhibit a variety of colors. A red specimen is known as bleeding heart. *Heartsease* and *gillyflower* are other names by which the plants are known. The fragrant, velvety flowers are much admired, and have gained for the plant a place in Northern hothouses.

WALL OF CHINA, THE GREAT. See GREAT WALL OF CHINA.

WALLOONS, *wal loonz'*, a Celtic race inhabiting Southern Belgium. They are the descendants of the ancient Belgae and resemble the French more than they do the Germans, being short and mostly of dark complexion. Their language, also called Walloon, is a French dialect, retaining numerous Gallic words, but it varies somewhat in the different provinces. There are about 2,750,000 Walloons now in Belgium.

WALL PAPER, paper used for decorating the walls and ceilings of rooms. It was invented by the Chinese about 2,000 years ago, but was unknown elsewhere until about the year 1350, when importations from China reached Europe. The first factory for its manufacture in Europe was built in France in 1750. The French still call it *papier paint,* because for many years in that country it was hand-painted. It came into quick popularity in Europe as a substitute for the expensive tapestries, brocades, and velvets that were the wall adornments of the wealthy. Today more wall paper is made in the United States than in any other country, its production there reaching 325,000,000 rolls a year, enough to put a belt almost sixty times around the world. European manufacturers still adhere quite largely in choice of patterns to copies of tapestries and historic and mythological designs, but American stylists specialize in new designs; one American manufacturer produces about 3,000 different styles of prints. The design in the sheet, which is printed on presses resembling printing presses, is repeated at intervals; and when the paper-hanger puts it on the wall he is careful to match the pattern.

WALL STREET, the center of financial operations in the United States, so called from the street in lower New York City, upon which are located the New York Stock Exchange, the Consolidated Exchange and numerous banking institutions that figure largely in the money market. The street itself extends from Broadway to East River, following the line of the old city wall built by Governor Peter Stuyvesant in 1653 to protect the town from possible attacks by the Indians. This wall, repaired and replaced from time to time, formed for fifty years the northern boundary of the future metropolis of the Western world.

WALNUT, *wawl'nut,* a genus including about twelve species of beautiful trees, mostly natives of North America and Asia. The three best-known species in America are the *English,* or *Persian* walnut, the *black* walnut and the *white* walnut, or *butternut.*

The English, or Persian walnut is a native of Persia and the Himalaya region, and is extensively cultivated on the California coast and in Southern Europe. It is a handsome tree, attaining a height of from sixty to ninety feet. It yields a sweet sap, somewhat like that of the sugar maple. The nut, which grows in a thin, wrinkled, two-valved shell, has a high food value, being a greater heat producer than almost any kind of meat. The unripe nuts are much used for making pickles and ketchups. The wood, called Circassian walnut, is valuable for cabinet work. It has been much used for interior finishing and for furniture, but is becoming rare. A beautiful brown dye is obtained from the bark.

WALPOLE, *wawl'pole,* Horace, Sir, fourth Earl of Orford (1717-1797), an Englishman of letters, the son of Sir Robert Walpole. He received his education at Cambridge, and following his graduation spent several years in travel. In 1741 he entered Parliament. His first publication was *A Catalogue of Royal and Noble Authors.* It was followed in 1764 by *The Castle of Otranto,* a romance abounding in mystery, which at the time of its publication was very popular. Walpole is, however, chiefly remembered for his *Letters,* which give entertaining pictures of the society of his day.

WALPOLE, Hugh Seymour (1884-1941), an English novelist, born in Auckland, New Zealand. He was educated at Cambridge University, where he wrote two novels. From 1910 on, his books met with general public favor, and he was in demand as a lecturer both in England and the United States. Walpole's novels picture his country's life and people in different periods of England's history. He wrote with vigor and with a true understanding of human character. *The Dark Forest* and *The Secret City* grew out of his experiences with the Russian Red Cross in the first World War. *The Cathedral* and *The Old Ladies* picture life in a cathedral town, somewhat in the manner of Anthony Trollope, whose biography he wrote. *Rogue Herries, Judith Paris, The Fortress, Vanessa* and *Bright Pavilions* are a series of novels forming the well-known "Herries Chronicles," which have been adapted for the stage, screen and radio. Walpole's other books include *The Young Enchanted, Portrait of a Man with Red Hair, Wintersmoon, Hans Frost, The Roman Fountain* and the *Jeremy* stories.

WALPOLE, Robert, Sir, first Earl of Orford (1676-1745), an English statesman. He was educated at Eton and at King's College, Cambridge, succeeded to his father's estate in 1700 and entered Parliament as member for Castle Rising. In 1702 he was elected for King's Lynn, became an active member of the Whig party and soon distinguished himself by his business capacity and by his ease in debate. As Chancellor of the Exchequer, First Lord of the Treasury and, from 1721 to 1742, head of the Cabinet, Walpole laid the foundation of England's political stability and later prosperity. His career covered parts of the reigns of the first two Georges.

THE WALRUS

WALRUS, a marine flesh-eating mammal, related to the seal, and inhabiting the colder climates. It is larger and heavier than the seal, and when full-grown will measure twelve feet in length and weigh about 2,000 pounds. When young, it is covered with thick, dull brown fur, but as it gets older this falls out, and when full-grown the walrus has practically no fur or hair on his wrinkled skin. The most characteristic feature of the walrus family is the pair of large pointed tusks (canine teeth) which project downward from the upper jaw. These tusks are of solid ivory, and are often from twenty to thirty inches in length. Walruses use them as tools and as weapons—to dig up clams and other food, to climb on ice and rocks, and to defend themselves from foes, especially from the polar bear, their chief enemy. Two species of walrus are found. The Atlantic walrus is found in the waters about Greenland and Labrador. The Pacific species occurs off the islands of the Bering Sea, but their numbers are diminishing rapidly. They are hunted for their hides and oil and for ivory, and by the natives on the Arctic coasts for food. They are either killed with the rifle or taken with harpoons.

WALTHAM, *wol'tham,* Mass., a city in Middlesex County, ten miles west of Boston, on the Charles River. It manufactures more watches than any other city in Massachusetts; its watch factories are among the largest in the world. It is well known also as a center for precision instruments and small machined parts, and is one of the largest salesbook manufacturing centers in New England. Middlesex University is located here. Waltham, originally a part of Watertown, became a separate town in 1738 and a city in 1884. Population, about 47,000.

WALTON, *wawl'ton,* **Izaak** (1593–1683), the author of the famous *Compleat Angler,* a treatise on fishing. For a number of years he was in business in London, as a linen draper according to some accounts; as an ironmonger according to others. He retired at the age of fifty and devoted his remaining forty years to a life of cultured ease and pleasure. His first edition of *The Compleat Angler* appeared in 1653. It is to his exquisite delineations of rural scenery, the ease and unaffected humor of his dialogue and the delightful simplicity of his style that *The Compleat Angler* owes its charm.

WALTZ, *wawlts,* a dance of Bohemian origin, executed with a rapid whirling motion, the gentleman having his arm round his partner's waist. The music is written in triple time and consists of phrases of eight or sixteen bars. Several of these phrases are now usually united, to prevent monotony. Johann Strauss and his son of the same name are the most noted composers of waltzes. The *valse à deux temps* is a form of waltz in which two steps are made to each bar of three beats. *Classical waltzes* are musical compositions in waltz form, not intended for dance tunes. Of this style the composer Chopin is the greatest master.

WAMPANOAG, *wom pa no'ag,* a tribe of Algonquian Indians who once occupied the lands east of Narragansett Bay, as far north as Massachusetts. Their number was reduced from 30,000 to barely 1,000 by a fearful epidemic, and a subsequent war with the whites resulted in their complete destruction. Massasoit and his son Philip were famous men of the tribe. See Massasoit; King Philip.

WAMPUM, *wom'pum,* white and purple shell beads used for ornament and circulated in colonial days as money among Indian tribes east of the Mississippi. Because of the fixed value given to wampum strings, they came to be accepted by the New England colonists in exchange for their own coins. In some localities six wampum beads equaled a penny. It was the custom of the Indians to weave wampum beads into belts, in such a manner that the figures formed permanent records. Few transactions of any sort were considered complete without the passing of the belts, and wampum records were invariably used in the ratification of treaties. Many wampum belts of historic importance are preserved in the state archives at Albany, New York.

WANAMAKER, *wahn'a ma kur,* **John** (1838–1922), an American merchant, capitalist and philanthropist. He was born in Philadelphia, Pa., and there received a common school education and began his business career as errand boy in a book store; later he was a salesman, and in 1861 he established a clothing house, which he enlarged into a general department store in 1876. In 1896 he opened a branch in New York City.

He helped to organize the Christian Commission, which assisted the soldiers during the Civil War; was chairman of several relief committees, and was prominent in the management of the Centennial Exposition. Wanamaker was appointed Postmaster-General in 1889 and performed his duties with energy and administrative ability. He also took great interest in religious work and actively supported the Young Men's Christian Association. As one of the founders of the Presbyterian Hospital and Bethany Dispensary, as originator and president of the first Penny Savings Bank and as a donor to numerous charities he was one of the most influential men of his time.

WANDERING JEW. A legend, well known in almost all parts of the Christian world, says that while Christ was on his way to Calvary, bearing his cross, he was mocked by a Jew, who told him not to rest, but to hurry on with his burden. In reply, Christ said, "I go, but thou shalt tarry till I come." In consequence, the man has continued since to wander about the earth. He passes through his lifetime like any ordinary man, till he reaches one hundred years, and then he suffers a terrible sickness, after which he comes forth again young. This legend has been the subject of many literary works in prose, poetry and the drama. The most notable novel is *The Wandering Jew* by Eugene Sue.

WANDERING JEW, a creeping plant with glossy leaves having a silvery sheen and often a purplish cast. It grows in almost any soil, and even in water; and the persistency with which it lives and its manner of growth are responsible for the name. The plant grows and spreads rapidly and is used to advantage in hanging baskets and along the sides of window boxes. In the warmer of the temperate climates the plants live out of doors and often attain a length of several yards.

WAP'ITI. See Elk.

WAR, a contest between nations or states (international war), or between parties in the same state (civil war), carried on by force of arms. The causes of war are many. It may arise from disputes about territorial possessions and frontiers, unjust dealings with the subjects of one state by another, economic competition and oppression, questions of race, jealousy of military prestige or mere lust of conquest. Nearly all civil wars are due to the claims of rival contenders for supreme power in the state, or to attempts to establish some important point connected with civil, religious or political liberty. In all cases the aim of each contending party is to overthrow or weaken the enemy by the defeat or dispersion of his army or navy, by the occupation of important parts of his country, or by the ruin of his commerce, thus cutting off his resources of recuperation. In practically every instance, propaganda, much of it patently false, encourages the sentiment for war.

When war is carried into the territory of a hitherto friendly power, it is called an *aggressive,* or *offensive,* war; and when carried on to resist such aggression, it is called *defensive.* Previous to the outbreak of hostilities between states, the power taking the initiatory step may issue a *declaration of war,* which often takes the form of an explanatory manifesto, addressed to neutral governments (see War, Declaration of).

During the progress of the struggle, certain laws, usages or rights of war have come to be generally recognized; such laws permit the destruction or capture of armed enemies, the destruction of property likely to be serviceable to them, the stoppage of their channels of traffic and the appropriation of everything in an enemy's country necessary for the support and subsistence of the invading army. On the other hand, though an enemy may be starved into surrender, wounding, except in battle, mutilation and all cruel and wanton devastation are contrary to the rules of war, as also are bombarding an unprotected town, the use of poison and the employment of torture to extort information from an enemy. Works of art and the industries of peace should be exempt from destruction. The First World War, however, showed that in actual conflict these rules may be disregarded. In that war, poison gas was first used by the Germans; the airplane and tank were introduced into modern warfare and the submarine for the first time became a significant tool of destruction in wartime. The Second World War was to an unprecedented degree a war against civilians. The use of powerful mechanized units and aerial bombing brought vast destruction to civilian life and property in the countries that were attacked.

When two warring nations must communicate, they customarily request the services of the embassies of some neutral powers, who make the preliminary arrangements before the belligerents themselves meet; in the Russo-Japanese War, for example, negotiations were carried on by the United States government. When the belligerents wish to meet to discuss peace terms or for any other reason, an *armistice* or *truce* is declared, during which hostilities cease.

Formal agreements officially ending wars are known as *treaties.* The inclusion of the Covenant of the League of Nations in the Treaty of Versailles, ending World War I, was an effort to prevent another war. The charter of the United Nations, growing out of World War II, had the same purpose.

Related Articles. Consult the following titles for additional information:

Airplane
Army
International Law
Nations, League of
Nations, United
Navy
Neutrality
Tank
Treaty
World War (I, II)

WAR, Declaration of, a formal announcement by one nation of its intention to begin hostilities against another, or a statement recognizing the existence of a state of war between the two nations. With the modern facilities for rapid communication, actual warfare may be preceded by negotiations of longer or shorter duration. A common procedure is for one nation to send an ultimatum to the other, setting a definite time for a reply. On Sept. 3, 1939, for example, Great Britain sent an ultimatum to Germany, demanding the withdrawal of German troops from Poland within two hours; this it followed with a declaration of war when Germany failed to reply. It sometimes happens that hostilities begin without a formal declaration. What developed into war between Japan and China began with Japan's unannounced invasion of North China in 1937. The United States, however, declared war against Japan when that country attacked Pearl Harbor without warning on Dec. 7, 1941. Hitler's forces invaded Russia in June, 1941, shortly after a declaration of war was announced by Germany, but in that conflict, which became World War II, it attacked other European countries without warning.

WAR, Department of, that one of the executive departments of a government which has to do primarily with military affairs. The former United States Department of War was created by Congress in 1789. It was headed by the Secretary of War, who was a member of the President's Cabinet. In 1947 Congress authorized a merger of the armed forces, placing them under an over-all department called the National Military Establishment. This is headed by the Secretary of Defense, who is a member of the Cabinet. The Department of War became the Department of the Army, and its head was made the Secretary of the Army. The Army Department is one of three co-ordinate divisions of the Military Establishment, the other two being the Department of the Navy and the Department of the Air Force. Each is headed by a Secretary. The three Secretaries are responsible to the Secretary of Defense, but are not members of the Cabinet. See Defense, Department of.

WAR'BLERS, a family of tiny, insect-eating birds, found throughout the western continent, about seventy species of which reach the United States. Their migration northward is made with great regularity, and in May and early June they are commonly observed everywhere in the Northern states. In nesting, however, most species seek the deep woods, some penetrating as far northward as the Hudson Bay and Yukon regions. Nearly all spend the winter in the tropics.

Some of the better known species of warblers are the *yellow warbler,* or *summer yellow bird,* which remains about Northern homes and parks throughout the summer; the *black and white warbler,* which creeps about the branches of trees in early spring; the *myrtle warbler,* marked with four yellow patches on head, rump and wing; the *black-throated green* and the *black-throated blue warblers,* the *chat,* the *American redstart* and the *oven bird.* Some warblers have fine singing voices, but the greater number have only weak, lisping notes. Their nests are usually cup-shaped, woven of twigs and grasses and placed in trees or bushes. The eggs are from three to five in number. See Birds; Oven Bird; Redstart.

SOME OF OUR SONG WARBLERS

WARD, a minor placed under a guardian who has been appointed by the courts and who becomes legally responsible for the protection of his rights. The child must obey his guardian; he may not marry without his consent and may not bring suit against him, though in cases of unjust treatment he may file a complaint with the court. In most cases wardship ceases with marriage and always when the ward becomes of legal age. See Guardian.

WARD. See Municipal Government.

THE BATTLE OF NEW ORLEANS

WARD, Artemus. See Browne, Charles Farrar.

WARD, John Quincy Adams (1830–1910), one of the foremost American sculptors of his day, was born at Urbana, Ohio. Before the Civil War he established himself in New York and became known for his portrait busts of notable people. His statuette *The Freedman,* made in 1865, was so popular that thousands of copies were sold; his *Indian Hunter,* which also makes a strong popular appeal, was the first piece of statuary erected in Central Park, New York City. *The Good Samaritan,* a group commemorating the discovery of the efficacy of ether as an anesthetic, is in Boston. Ward's bronze bust of Shakespeare, a seated figure of Horace Greeley and statues of George Washington and Thomas Jefferson are among his finest portrait statuary. Ward was identified with the leading art organizations of his time and labored unremittingly to elevate national ideals in the field of art.

WARNER, Seth (1743–1784), an American soldier, one of the leaders of the Green Mountain Boys, who opposed New York's claim to the New Hampshire grants. He was elected lieutenant-colonel of the Green Mountain Boys in 1775, and the following year was appointed colonel of the continental regiment. He received a colonel's commission for the part he took in the capture of Crown Point. He was in command at the Battle of Hubbardton and rendered efficient service in the Battle of Bennington. In 1782 he retired from the army on account of ill health.

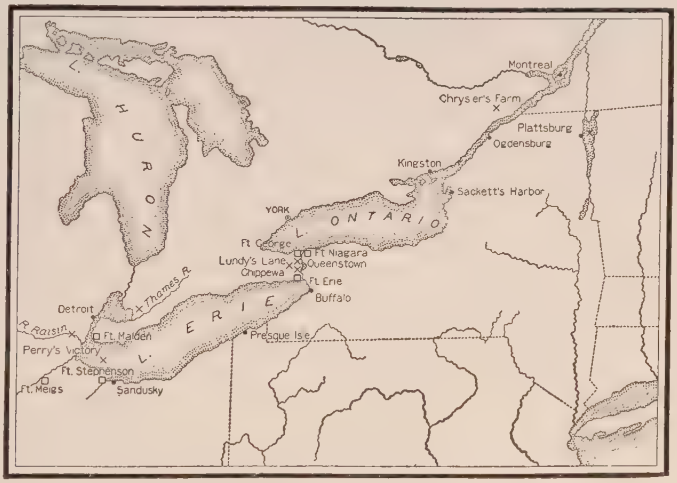
WAR OF 1812, the name given to the struggle between the United States and Great Britain in the years 1812–1814. The general cause of the war was the attitude of Great Britain in relation to American shipping. Its claims to the right to board and search American vessels for the purpose of impressing British citizens, found in their crews, into the British service; its decrees and orders to the detriment of American commerce; and its disregard of American protests, which had been a cause for grievance to the Americans for years, at last compelled them to attempt to secure reparation by force. The same haughty actions regarding American commerce had been taken by France, and it was long a question as to which of the two powers the United States would fight first; but the proximity of Canada, which seemed to offer an attractive field for conquest, and the old ill-feeling toward England, resulting from the Revolution, finally caused the declaration of war against Great Britain, on June 18, 1812. Five days later the British government withdrew the "Orders in Council," which had been probably the most objectionable features of the British policy, since they established a paper blockade of European ports and practically excluded American commerce from the seas.

At the outset the land forces of the United States made little headway. Great Britain, with her vastly superior resources, was prepared for war, having been at war with France for many years, while the United States government had shown a shameful lack of appreciation of the dangers attending the new republic and had allowed the navy and war departments to deteriorate almost out of existence. The first military movement was that of General Hull, who invaded Canada with two thousand men, but soon retreated before an inferior force under General Brock and surrendered at Detroit, August 16. In October of the same year, General Van Rensselaer made another invasion of Canada near Niagara Falls, and after the Battle of Queenstown, in which the British general, Brock, was mortally wounded, the Americans were again driven back with great loss. Meantime, on the sea the United States vessels had some success. The *Constitution* had captured the British frigate *Guerriere* (August 19). The *Wasp*, after a sharp battle, took the *Frolic*. The *United States* captured the *Macedonian*, and in December the *Constitution* compelled the surrender of the frigate *Java*.

Of the American navy it can be said that at the beginning of the war there were practically no war vessels owned by the government. So badly in need of a naval arm was the country that privateers (which see) were licensed. A few naval vessels were assembled; these in 1812 and 1813 gave so good an account of themselves in action that the naval history of the war was remarkable. American valor on the sea made forever memorable such names as the *Constitution* ("Old Ironsides"), the *Wasp* and others scarcely less notable.

In the spring of 1813 General Dearborn, who had been placed at the head of affairs in the Northwest, invaded Canada for the third time, with an army of 1,700 men, and captured York (Toronto). He was relieved by Generals Wilkinson and Hampton, who made an attempt to take Montreal, but without success. In May an advance of the British into New York State was repulsed at Sackett's Harbor, and in September Commodore Perry fought the famous Battle of Lake Erie, by which he captured the most important British fleet upon the Great Lakes. This victory enabled General Harrison to invade Canada. There he defeated General Proctor, in the Battle of the Thames.

In 1814 General Jacob Brown again invaded Canada, captured the British Fort Erie and defeated the force under General Riall at Chippewa. Then followed the Battle of Lundy's Lane and the withdrawal of the Americans to Fort Erie, where they were besieged. In the following September, General Provost led 14,000 men in an invasion of New York, by way of Lake Champlain. The fleet which he had got together was defeated near Plattsburg by an American fleet under Commodore McDonough, while the land force was also repulsed. At about the same time, the British fleet ascended Chesapeake Bay, defeated the hastily sum-



MAP OF MAIN OPERATIONS

moned American militia at Bladensburg, entered Washington and sacked the government buildings, in retaliation for the sack of York at its capture.

Meanwhile, General Andrew Jackson had been fighting the Creek Indians in the extreme South and had gathered together an army of Kentucky and Tennessee frontiersmen. In January, 1815, this force was confronted by an army sent direct from England under General Pakenham and consisting of the veterans of Wellington's campaign against Napoleon. The result was the famous Battle of New Orleans.

On the sea the Americans continued to gain the upper hand, though the *Chesapeake* was captured by the *Shannon,* and other small American vessels were taken. Probably the most memorable event upon the sea during this period was the famous cruise of the American frigate *Essex,* which, after a long and brilliant career against British merchantmen, was compelled to surrender to the *Phoebe* and the *Cherub* in the Pacific Ocean, March 28, 1814. The very month in which the treaty of peace was signed, December, 1814, the Federalists of New England declared their opposition to the war. The Treaty of Ghent provided for the restoration of all lands captured by either side and for a commission to determine the boundary between the United States and Canada. It did not provide for the withdrawal of the British claims regarding right of search, the paper blockade and the laws of neutrality. These practices had already been discontinued by the British, on demand of their merchants, and were not revived.

Related Articles. Consult the following titles for additional information:

Blockade
Brock, Sir Isaac
Champlain (lake)
Constitution, The (ship)
Continental System
Embargo
Ghent, Treaty of
Hartford Convention
Hull, William
Jackson, Andrew
Lawrence, James
Lundy's Lane, Battle of
Neutrality
New Orleans, Battle of
Perry, Oliver Hazard
Raisin River, Massacre of
Search, Right of
Star-Spangled Banner
Thames River, Battle of the
Tippecanoe, Battle of
United States of America (history)

WARRANT, a writ issued by any qualified court officer directing a constable or sheriff to arrest the person named therein and bring him before the official issuing the warrant. A warrant is usually issued upon the oath of a complaining witness as to the guilt of the person concerned. Arrests without a warrant are illegal, except in time of public danger, or when an overt act is witnessed by a peace officer.

WARREN, Earl (1891–), Chief Justice of the United States Supreme Court, was born in Los Angeles, Calif. He graduated from the law school of the University of California and served in the army in World War I. After 1919 he worked for the state government, becoming a district attorney in 1925. In 1938 he was elected attorney general, and in 1942 he became governor of California. Warren was serving his third term in 1953, when he was chosen by President Eisenhower to succeed Chief Justice Vinson.

WARREN, Joseph (1741–1775), an American patriot, born at Roxbury, Mass. He was graduated from Harvard College and became a physician at Boston and a leading figure in Massachusetts political movements, contributing with voice and pen to the cause of patriotism. He drew up the "Suffolk resolves," the most radical expression of the American position with respect to British oppression, and in the following year, 1775, was elected president of the provincial congress of Massachusetts. Although the rank of major-general of Massachusetts forces had been conferred on him, and he was offered chief command at Bunker Hill, he took his place as a volunteer and was killed in the fight of June 17. A monument in his memory, erected in 1794 on the spot where he fell, was later replaced by the Bunker Hill Monument. See Bunker Hill.

WARREN, Ohio, the county seat of Trumbull County, fifty-two miles southeast of Cleveland, on the Erie, the Baltimore & Ohio and the Pennsylvania railroads. It is said to be the second city in the United States in the manufacture of electric lamps. Steel and other metal products, vitreous enamel products and rubber specialties are also important manufactures. John Packard was born in Warren, and the first Packard motor car was manufactured here. Warren was settled in 1799, and was incorporated as a town in 1834 and as a city in 1869. Population, about 50,000.

WAR'SAW, or **WARSZAWA,** the capital of Poland, has suffered repeated assaults during its long and dramatic history, but the city has always managed to survive. It is located on the west bank of the Vistula River, which connects it with the Baltic Sea and contributes greatly to its commercial importance. Traffic between Soviet Russia and western Europe also passes through the city. From the level countryside around Warsaw comes agricultural produce to be processed in the city's mills and factories. Warsaw supplies a large part of Poland with manufactured goods.

In the sixteenth century, several hundred years after it was first founded, Warsaw became the capital of the kingdom of Poland. Poland's stronger neighbors, Sweden, Prussia and Russia, invaded the country at intervals and occupied the capital. An independent duchy of Warsaw existed from 1807 to 1813, under Napoleon's protection. From 1813 until the end of World War I, Russia held Warsaw and suppressed the frequent rebellions of Polish patriots.

Warsaw, in free Poland, flourished until 1939. At the beginning of World War II, Germany swiftly made the Poles a captive people. After a Jewish revolt in Warsaw in 1943, the Jewish "ghetto" was almost completely destroyed, along with its inhabitants. When the Russians pushed into Prague, Warsaw's industrial suburb across the Vistula, in 1944, the Poles rose up against the Germans, only to be crushed after sixty-three days of savage fighting.

The Germans burned and blasted the city into rubble before Russia liberated it in January, 1945. Warsaw emerged from the war as the seat of the Communist-dominated government of Poland. Its prewar population was more than 1,265,000; its postwar population was about 500,000. After the return of peace, business, industry and transportation recovered with amazing speed. See POLAND.

WARSHIP. See NAVY; SUBMARINE; TORPEDO BOAT.

WART, an excrescence of the skin caused by hardening of the papillae. Warts are usually the result of some form of irritation, and appear most commonly on the hands of children. They may disappear after a time, or may persist through life. There have been many superstitious beliefs as to methods of removing warts, but the only reliable way is that of having them cauterized by a physician, or treated with lactic acid or a similar chemical. Senile warts result from a breaking down of the skin, favored by irritation or lack of cleanliness, and are usually found on the back, neck and arms.

WART HOG, a wild pig, native to Africa. It stands about three feet high, having rather long legs. The face is rendered extremely hideous by large tusks and wart-like protuberances under the eyes and at each side of the huge snout. The coarse hair, short on the rest of the body, is long on the back and hangs in a mane on the neck. These hogs roam in small groups in search of food, and are destructive to crops. There are two principal species, one in Abyssinia and Somaliland, and the other in South Africa.

WARWICK, RICHARD NEVILLE, Earl of, called the "king-maker" (1428–1471), an English soldier and statesman. He was the son of the Earl of Salisbury and became Earl of Warwick after marrying the heiress of the Warwick titles and estates. Taking the Yorkist side in the Wars of the Roses, he was the main instrument in placing Edward IV on the throne in 1461, in place of Henry VI, and he became the most powerful nobleman in the kingdom. He quarreled with Edward, however, on account of the latter's marriage, went over to Henry's side and was able to place him again on the throne, but was defeated and slain at the Battle of Barnet.

WASATCH, *waw′satch*, **MOUNTAINS**, a range belonging to the Rocky Mountain system. It extends from Southeastern Idaho to Southwestern Utah, forming the eastern boundary of the Great Basin in which lies the Great Salt Lake. The mountains rise abruptly from the plain and reach an average height of 10,000 feet. The highest peak, Mount Belknap, reaches 12,000 feet above sea level. The peaks, covered with perpetual snow, are the source of numerous streams, and the region is broken by canyons.

WASHING MACHINE, a mechanism of varied types and sizes for washing clothes, fabrics, etc., in the home and public laundries. The clothes are placed in a waterproof metal cylinder and agitated by an inner device containing cleansing solutions. The direction of rotation is reversed automatically every few revolutions, thus displacing dirt by forcing soap and water through the clothes. Most machines are electrically equipped. Many have roller attachments for wringing and mangling. All have safety features, the moving parts being covered to avoid accidental catching of clothes. Some machines have automatic timers that turn off the current.

WASHINGTON, a state of the American Union, in the extreme northwestern part of the country, south of the international boundary and on the Pacific coast. Its popular name, THE EVERGREEN STATE, refers to its wealth of fir forests. About seventy per cent of the surface is forest-covered, and in the annual production of lumber Washington is the leading state in the Union. The rhododendron is its flower emblem.

Location and Area. The state is bounded on the north by the Canadian province of British Columbia, the forty-ninth parallel forming the line between the two divisions. Extending into the northwestern part of the state is the irregular, much-branching inlet, Puget Sound, which is connected with the open ocean by the straits of Juan de Fuca and Georgia. Between these straits lies the island of Vancouver, which is wholly Canadian territory, though it extends south of the international boundary. Washington touches the north extension of Idaho on the east, and along most of its southern border it is separated from Oregon by the Columbia River.

With an area of 68,192 square miles, of which 1,406 square miles are water, the state is the nineteenth in size in the Union. It is more than two-thirds the size of Oregon, its neighbor to the south, and over twice the size of Maine, which is the largest state in the New England group.

People and Cities. In 1950 Washington ranked twenty-third among the states in population, with 2,378,963 inhabitants, an increase of 37.5 per cent over the census figures for 1940. It ranked thirty-second in density of population in 1950, with an average of 35.6 persons per square mile. The census classified 63.2 per cent of the population as urban. Canadians, Swedes, Germans, English, Norwegians, Finnish, Indians, Negroes, and Japanese are the chief minority groups in Washington. The principal religious bodies are the Roman Catholic, Methodist, Presbyterian, Lutheran, Baptist, Disciples of Christ, and Congregational denominations.

According to the 1950 census, Washington then had twenty-five cities with populations of more than 10,000. The eight largest were: Seattle, 467,591; Spokane, 161,721; Tacoma, 143,673; Vancouver, 41,664; Yakima, 38,486; Fort Lewis, 35,000; Bellingham, 34,112; and Everett, 33,849. Olympia, the capital of the state of Washington, had 15,819 inhabitants. City populations increased rapidly during and after World War II.

Surface and Drainage. The Cascade Mountains cross the state from north to south about 120 miles east of the coast, and divide it into two unequal parts, Eastern Washington and Western Washington. These mountains form the chief physiographic feature of the state and have a mean elevation of about 8,000 feet. Their eastern slope rises gradually from the interior plateau, but the western slope is steep and broken. The range contains a number of lofty peaks whose summits are covered with perpetual snow. The most noted among these are Mount Rainier, 14,408 feet, now enclosed in a national park, Mount Adams, 12,307 feet, Mount Baker, 10,730 feet, and Mount Saint Helens, 9,671 feet. Eastern Washington, which includes nearly two-thirds of the state, contains the Columbia River Basin, which is by far the largest natural division of surface within the state. Within this basin are the great irrigated and grain-growing districts and a number of fertile valleys famous for fruit products. In the southeastern part the Blue Mountains rise to an altitude of about 6,000 feet.

Western Washington is naturally divided into three physiographic regions—the Puget Sound Basin, including the territory between the Olympic and Cascade mountains, and surrounding the great inland sea, Puget Sound; the Olympic Peninsula, including that portion of the state containing the Olympic Mountains and the region extending from them to the Pacific, and the southwestern division, which occupies the region fronting on the Columbia River and Pacific Ocean and extending northward until it meets the Olympic Peninsula. The Olympic

THE SEAL OF THE STATE OF WASHINGTON 1889

WASHINGTON

THE EVERGREEN STATE

STATE FLOWER RHODODENDRON

(1) A typical fruit-growing valley. (2) Salmon at the cannery. (3) Great wheat ranches yield enormous crops. (4) In Mount Rainier National Park, famous for its beautiful glaciers. (5) Bonneville Dam on the Columbia River, a unit in the Federal project built to provide electric power and water for irrigation. (6) Stands of fir and pine furnish lumber for a great industry.

Mountains are the northern extension of the Coast Range.

The eastern section of the state, or Eastern Washington, is drained entirely by the Columbia River and its tributaries. This river enters the state near the northeastern corner and flows south by west, then westward, in an irregular course, then southward and southeastward until it reaches the southern boundary, when it makes a sharp turn to the west and pursues its course to the Pacific. These changes in direction form what is known as the Great Bend in the Columbia River, and this is for a part of the way the western boundary of the plateau. The chief tributaries of the Columbia are Clark Fork, from Idaho; the Snake, which flows through the southeastern corner of the state; the Spokane, the Okanogan, the Methow, the Wenatchee and the Yakima. Western Washington is drained into Puget Sound and the Pacific. In this section all of the rivers are short and comparatively unimportant, the most important being the Cowlitz, flowing southward into the Columbia, the Chehalis, flowing directly into the Pacific, and the Skagit, which enters Puget Sound. The state contains a number of mountain lakes, the largest being Lake Chelan.

Climate. The Cascade Mountains divide the state into two climatic regions. Eastern Washington is characterized by hot summers, cold though not severe winters and light rainfall, the annual average being about sixteen inches. In many sections irrigation is necessary to successful agriculture. Except upon the high altitudes there are many hot days during the summer. During the winter there are heavy falls of snow, which are welcomed by the farmers, because as the snow on the lowlands melts, it is absorbed by the soil, and that upon the mountains during the summer feeds the streams which supply water for irrigation. The climate of Western Washington is mild and moist. The prevailing westerlies, blowing moisture-laden from the sea, strike the cool slopes of the mountains and their moisture condenses into rain. West of the Cascades the annual rainfall ranges from twenty to 132 inches. The winters are mild and the summers are free from extreme heat.

Mineral Resources. There are extensive deposits of coal in the Puget Sound Basin, notably in King, Pierce, Lewis, Whatcom and Thurston counties, also in Kittitas County, east of the Cascade Range. Coal is Washington's leading mineral, and both bituminous and lignite varieties are found. The coal deposits of Washington are the only ones of any great extent on the Pacific coast.

Veins of ore producing zinc, gold, silver, copper, lead, quicksilver and a number of rare metals occur throughout the mountainous regions. Gold and silver are mined in Whatcom, Skagit, Snohomish, King, Pierce, Lewis, Skamania, Cowlitz, Okanogan, Chelan, Kittitas, Yakima, Klickitat, Ferry and Stevens counties. Iron ore, and marble, granite, onyx, serpentine, limestone and sandstone occur in large quantities. Beds of fire clay, kaolin, talc and asbestos are among the valuable resources of the state.

Fisheries. The waters of Puget Sound, the Columbia River and the indentations along the Pacific coast abound in excellent food-fish, and in the lakes and streams are found large quantities of fresh-water fish. The most important branch of the fisheries is catching and curing salmon (see SALMON). Second in point of value are the halibut fisheries. Large quantities of oysters, shrimps, clams and cod are also taken. In value of products of the fisheries Washington usually ranks fourth among the states.

Agriculture. This is the principal occupation in Washington. There is wide variety of soils. On the uplands of Eastern Washington wheat and other cereals are raised in large quantities. In the diked lands along Puget Sound oats are raised, and in the southeastern part barley constitutes the important crop. Rye, buckwheat and flax are also grown, and in some counties hops are a staple product. Many large irrigated areas east of the mountains are devoted to alfalfa. Potatoes, beets and other vegetables thrive and yield large returns.

Washington is one of the most important fruit-growing states of the Union, and leads in the production of apples. In the valleys of Eastern Washington there are thousands of orchards. This region is especially valuable for the raising, not only of apples, but also pears, peaches, plums and cherries. In the western part of the state small fruits are raised in large quantities, and grapes are grown upon both sides of the mountains.

The mild winters and excellent pasturage make the raising of livestock profitable, and large numbers of cattle, horses, sheep and hogs are found. For all of these there is a ready market. Dairying is also profitable and can be practiced under ideal conditions.

Manufactures. Washington has abundant water power and a vast forest area. Because of these conditions, lumbering and its allied industries—the manufacture of doors, sash, shingles and furniture—constitute the leading manufacturing industry. Lumber mills are very generally distributed through the forest regions, but the most extensive establishments are found on the shores of Puget Sound, near the large forests of Western Washington.

The products of the flour and grist-mills are second in value, the most important commodity of the industry being white flour. Slaughtering and meat packing, the canning and curing of fish, printing and publishing and railroad-shop construction and repair are all prosperous lines of activity. Seattle, Tacoma and other ports are centers of shipbuilding. Seattle is the chief manufacturing city of the state, with Tacoma, Spokane, Everett, Bellingham, Aberdeen, Walla Walla and Yakima following.

The mineral resources have given rise to various other industries. In the Puget Sound Basin large quantities of lime are produced. Granite is quarried in Snohomish and Spokane counties. In other localities valuable sandstone occurs, and onyx of great variety and beauty is quarried in Stevens County. In King County are factories for the manufacture of brick, tile, terra cotta, stoneware and sewer pipe. The total value of all manufacturing output is over $400,000,000.

Transportation. Puget Sound and the Pacific Ocean have a Washington coast line exceeding 2,000 miles in extent. The largest ocean ships can sail on the Sound as far as Seattle and Tacoma, which are the chief harbors of the state. Three transcontinental lines of railway cross the state from east to west. Railway lines extend north and south from the great centers of trade on Puget Sound, and connect all important cities and towns in the state and maintain junction points for cities in British Columbia. The most important roads are the Northern Pacific, the Oregon & Washington, the Great Northern, the Chicago, Milwaukee, Saint Paul & Pacific, the Pacific Coast Railroad, the Union Pacific and the Southern Pacific. The total mileage of the state is about 5,500. There are 18 airports and three major air routes. Five bus companies operate on seven principal routes running both east and west and north and south. There are 900 miles of electric railway and 16,870 miles of surfaced roads.

Government. The legislature consists of a house of representatives, that cannot exceed ninety-nine members or be less than sixty-three, and a senate, whose number cannot exceed one-half, or be less than one-third of the number of representatives. The representatives are elected for two years, and the senators are elected for four years. The legislature meets biennially, and the regular sessions are limited to sixty days. The executive department consists of a governor, a lieutenant-governor, a secretary of state, a treasurer, an auditor, an attorney-general, a superintendent of public instruction, a commisioner of public lands, and an insurance commissioner, elected for four years. The courts consist of a supreme court of nine judges, elected for six years, and a superior court in each county, presided over by a judge elected for four years.

Education. The public schools are under the direction of the superintendent of public instruction and a board of education. The schools are organized on the district plan, and each district must maintain a school for at least five months in the year. Education is compulsory between the ages of eight and fifteen. The school fund is derived from state and local taxes and from income from the permanent fund derived from the sale and lease of school lands. The yearly cost of the public schools is about $33,000,000. The white population of Washington shows the lowest percentage of illiteracy of any state in the Union. The state university is at Seattle and teachers colleges are maintained at Bellingham, Cheney and Ellensburg. The state agricultural college is at Pullman. Other colleges are located as follows: at Spokane, Gozanga University, Whitworth College and Spokane University; the College of Puget Sound at Tacoma; Walla Walla College at College Place; Whitman College at Walla Walla; Seattle Pacific College at Seattle.

Other Institutions. The schools for the deaf and the blind are at Vancouver. The hospitals for the insane are at Fort Steilacoom, Sedro Woolley and Medical Lake, and there is a soldiers' home at Orting and a veterans' home at Port Orchard. The penal institutions consist of the penitentiary at Walla Walla and the reformatory at Monroe. The state training school is located at Chehalis.

Items of Interest on Washington

The assessed valuation of taxable property is nearly a billion and a quarter dollars.

The lumber resources of Washington will probably last for one hundred years.

The northern boundary of the state was fixed by treaty in 1846. "Fifty-four forty or fight" was a popular slogan in the presidential campaign of 1844, and represented the demands of citizens respecting this boundary.

Girls and boys between eight and sixteen are compelled to attend school.

Suffrage was granted to women in 1910.

Nearly 20 per cent of the potential hydroelectric power of the nation is credited to Washington.

The slopes of the Olympic Mountains in northwestern Washington have deep gorges and dense forests of fir, and are almost inaccessible.

The foreign-born made up 11.6 per cent of the population in 1940.

There are eighteen Indian reservations in Washington.

Questions on Washington

Where are the Cascade Mountains?

Of what is the Columbia Plateau composed?

What is the principal drainage system in the state and which are the important tributaries?

What is the largest lake in Washington?

How many acres are there in the national forest reserves?

How do the fisheries rank among the states of the Union?

What is the importance of the state's annual output of minerals?

What are the leading crops?

What is the principal manufacturing industry?

How does the value of its products compare with that of other states?

Name four other important industries.

What will be the most startling sights when you visit Washington?

When was Washington admitted to the Union?

History. For early history, see OREGON, subhead *History*. The territory of Washington was separated from Oregon in 1853, and soon afterward the discovery of gold led to an influx of settlers, which in turn induced the Indians to plan a massacre, known as the Washington-Oregon War, in 1855. Indian strife continued, but growth of white population finally led to the acceptance of reservations by the Indians. After the Civil War, there were violent anti-Chinese agitations, which for a time retarded this territory's growth. Numerous attempts were made to secure statehood, and in 1889 the Omnibus Statehood Bill, admitting the two Dakotas, Montana and Washington, was signed by the President, and Washington became a state. The growth in the population and wealth of Washington since its admission has been uninterrupted. The Alaska-Yukon Exposition of 1909 at Seattle admirably celebrated the growth of the state. In 1922 the private sale of drugs for narcotic purposes was prohibited by law. In 1932 the Wenatchee hydroelectric dam across the Columbia River was completed, and ten years later the Grand Coulee dam was finished.

Related Articles. Consult the following titles for additional information:

CITIES

Aberdeen
Bellingham
Everett
Olympia
Seattle
Spokane
Tacoma
Vancouver
Walla Walla
Yakima

MOUNTAINS AND RIVERS

Cascade Range
Coast Range
Columbia River
Snake River

THE FIRST WHITE HOUSE

WASHINGTON, the capital of the United States of America, named for the first President of the republic and located on a site chosen by him. It lies on the Potomac River, 156 miles from Chesapeake Bay and 185 miles from the Atlantic. Washington is co-extensive with the District of Columbia, which covers an area of about seventy square miles. The southwestern border is formed by the Potomac, into which Rock Creek flows. The

Anacostia River cuts through the city a mile and a half from the southeastern boundary and flows into the Potomac at the southernmost point of the city.

By the Federal census of 1950, Washington had a population of 802,178, ranking ninth in size among American cities.

Plan of the City. Washington was laid out according to suggestions made by President Washington, who employed Pierre Charles L'Enfant, a French civil engineer, to prepare the plans for the proposed city. It is said that L'Enfant rode over the ground with the President and commissioners and grew enthusiastic over the location, deeming it a fit site for the capital of a "mighty empire." Jefferson furnished L'Enfant with plans of the great cities of Europe, but the French engineer, faithful to the inspiration he had received from Versailles, determined to have broad avenues, vistas, streets and parkings, which make Washington truly the "City of Magnificent Distances." The Capitol was located on a hill, which was then a thick wood; the lines of latitude and longitude which marked its center were carefully surveyed, and the streets and avenues were laid from this point with mathematical exactness. It was manifestly the intention that the chief front of the Capitol should be toward the east, and that the public buildings should be placed about that side; but many forces contributed to change this idea, and now the west front, with its great terraces topping the hill and with its magnificent stairways extending far down the side, is worthy to be called the main entrance.

From the middle of the four sides of the site of the Capitol extend four great streets, which separate the city into quarters, known as North West, North East, South West and South East. These four streets are known as North and South Capitol, East Capitol and the Mall. The last is a beautiful parked area, which takes the place of a West Capitol street. The streets running parallel to East Capitol and the Mall are named, both north and south, for the letters of the alphabet. The streets parallel to North and South Capitol are numbered consecutively east and west. Broad avenues, named for the states, traverse the city from northwest to southeast and from northeast to southwest. All of this will be clearly understood if the reader will study the accompanying map. In locating any place it is necessary, of course, to mention the quarter of the city. When this is done, the location is very definite; for instance, 1850 F Street N. W., would be known to lie between Eighteenth and Nineteenth streets on F Street, in the northwestern part of the city. In the addressing of mail to the North West section, it is customary to omit the letters *N. W.*, but those for the other three sections should always be written.

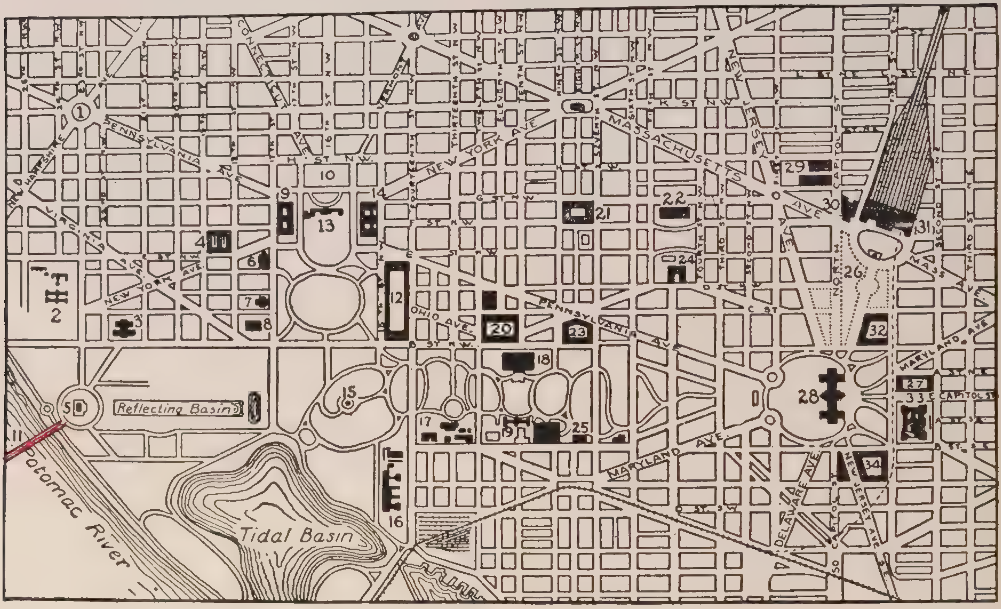
The North West quarter of the city contains most of the business houses, the finest residence section and most of the government buildings. Pennsylvania Avenue extends northwest from the Capitol for about a mile to the Treasury building; there it bends sharply to the north and again to the west, here passing in front of the Executive Mansion and the State, War and Navy building; beyond that it turns again to the northwest. F, G, Seventh and Ninth streets North West are among the important business streets.

Washington is connected with all of the states by the Baltimore & Ohio, the Pennsylvania, the Chesapeake & Ohio, the Southern and other railroads. All trains enter the magnificent Union Station north of the Capitol; the trains from the south must enter the station by way of a tunnel under Capitol Hill. An excellent highway system serves the city, as well as two airports—the Washington National Arport and the army's Bolling Field. Buses and electric railways afford easy transportation throughout the city and to Mount Vernon, Arlington, and other points.

Parks and Boulevards. The park surrounding the Capitol occupies sixteen city blocks, crowning a hill 58 feet high, overlooking the west half of the city. It is laid out with drives and walks, bordered by magnificent trees and beautiful shrubbery, interspersed with beds, in which blossom the flowers of the season. The small ornamental buildings, fountains and statuary lend a peculiar charm to the whole park.

From the west front of the Capitol a person looks down upon the broad Mall, which extends about a mile to the imposing Washington Monument, and then on to the Lincoln Memorial. In the Mall trees, shrubs and plants beautify the walks and drives. Along the north side of the Mall are grouped the great series of Federal buildings in the "triangle" area bounded by Pennsylvania and Constitution avenues on the north and south and by Fifteenth Street on the west. Running north from the west end of the Mall are the

Executive grounds, a magnificent tract which, with the private gardens of the White House, cover about twenty city squares. North of the White House and across Pennsylvania Avenue is Lafayette Square, another fine park adorned with fine statuary.



MAP AND KEY OF WASHINGTON, D. C.

1. Washington Circle.
2. U. S. Naval Hospital.
3. National Academy of Sciences.
4. Interior Department.
5. Lincoln Memorial.
6. Corcoran Art Gallery.
7. Continental Hall.
8. Pan-American Union.
9. State, War and Navy Building.
10. Lafayette Square.
11. Memorial Arlington Bridge.
12. Department of Commerce.
13. The White House.
14. Treasury Building.
15. Washington Monument.
16. Bureau of Engraving and Printing.
17. Department of Agriculture.
18. National Museum.
19. Smithsonian Institution.
20. Internal Revenue.
21. Patent Office.
22. Pension Office.
23. Archives Building.
24. Court House.
25. Army Medical Museum.
26. Capitol Park.
27. U. S. Supreme Court.
28. The Capitol.
29. Government Printing Office.
30. Post Office.
31. Union Station.
32. Senate Office Building.
33. Library of Congress.
34. House Office Building.

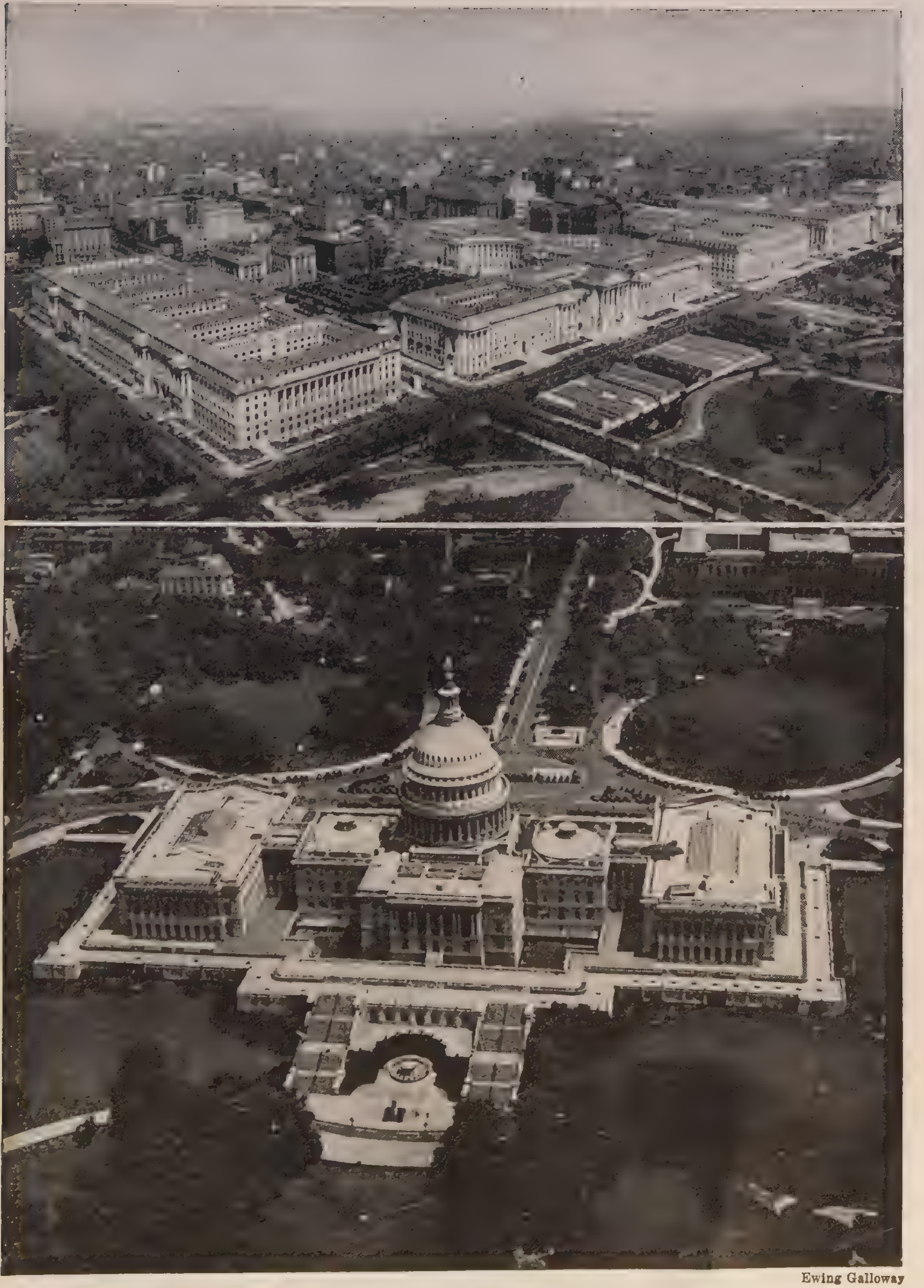
The intersections of the avenues and streets throughout the city form squares and circles which are public gardens filled with statuary, flowers and shrubs. Out beyond Rock Creek is the great National Zoological Park, which in time will become one of the greatest in the world. North and south of this extends Rock Creek Park, a tract which is preserved in all its natural beauty.

Along the river is Potomac Park, a tract of 737 acres, adjacent to the west end of the Mall, made up of reclaimed land. The Soldiers' Home four miles north of the Capitol is in a beautiful park of 500 acres. To the south of it is McMillan Park, containing a city filtration plant. In the spring, when the foliage is fresh and the flowers in the parks are in full bloom no more beautiful city is to be found.

A survey of the statues and memorials distributed over the city is both an extensive and a very instructive undertaking. Special mention should be made of the statues of George Washington, and statues of Andrew Jackson, Abraham Lincoln, Winfield S. Scott, John A. Rawlins, James B. McPherson, George H. Thomas, Joseph H. Henry, David S. Farragut and John Marshall. There are many others.

The memorials include the Emancipation Group, the Adams Memorial, Samuel Gompers and American Federation of Labor Memorial, among many others of equal or greater distinction.

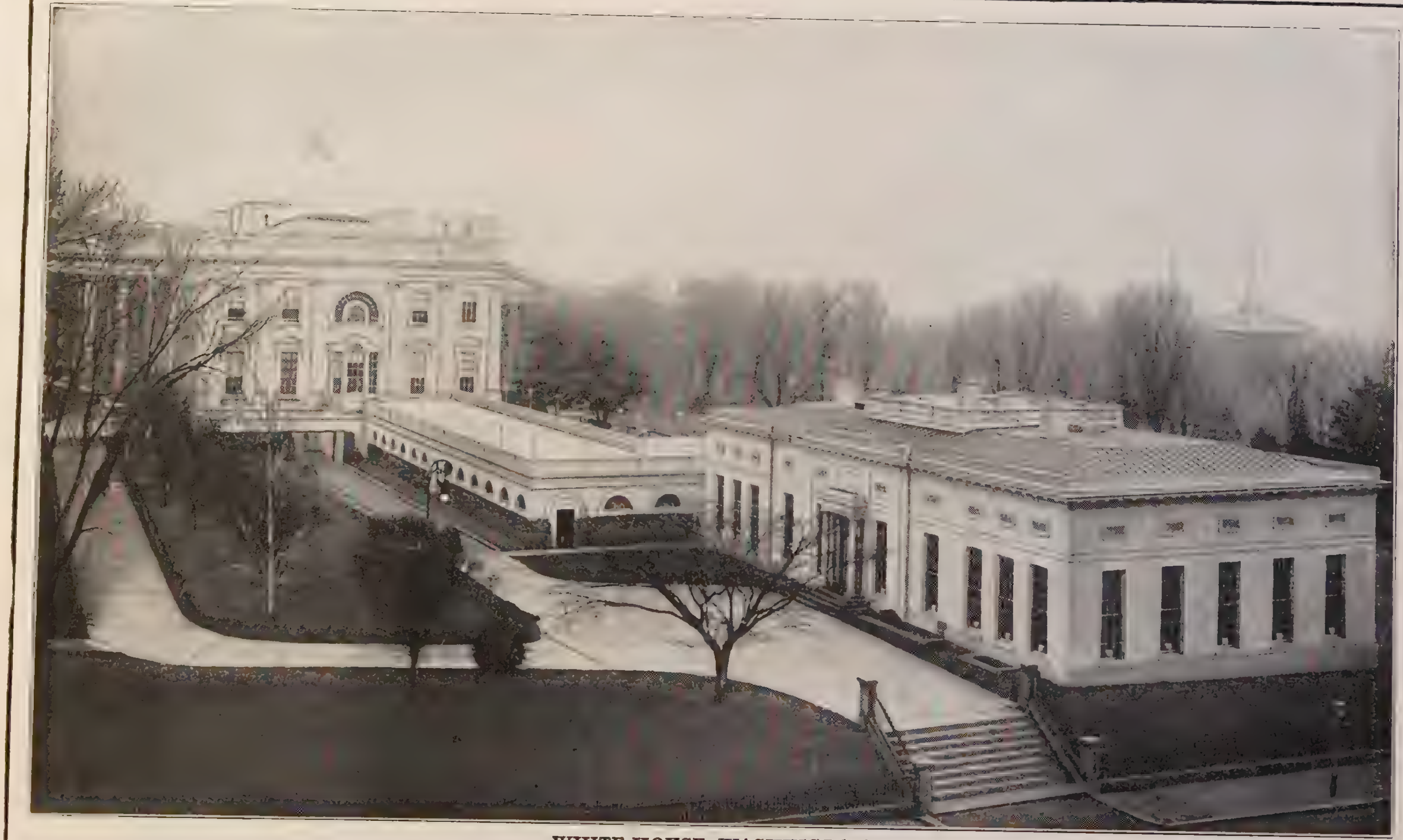
Public Buildings and Institutions. Chief of all the public buildings is the Capitol



Ewing Galloway

CENTERS OF ACTIVITY IN THE NATION'S CAPITAL

A new part of the City of Washington. Left to right, buildings for Department of Commerce; Department of Labor, and Interstate Commerce, with Postoffice Department at rear; Internal Revenue; Department of Justice; Archives Building. Below, the Capitol, from the air.



WHITE HOUSE, WASHINGTON

Showing western extension, containing President's business offices. A like extension has been added to the east side of the original building.

which because of its towering dome is conspicuous from any direction in which one approaches the city. The original plans for the Capitol were drawn by Doctor Thornton, a native of the West Indies, but they were redrawn by Stephen H. Hallet; they were followed in the construction of the first building, which little resembled the Capitol of to-day. The north wing was finished in 1800, but the opposite wing was not ready until eleven years later. A wooden passageway then connected them. After the British burned the Capitol in 1814, the new central structure was planned, and the original building was completed in 1827, at a cost of not quite $2,500,000. In 1851 the building was remodeled, and in 1856 the erection of the present iron dome was begun.

The Capitol as it now stands, together with its approaches, has cost about $26,000,000. The building is 751 feet long and 350 feet in its greatest width, and it covers nearly four acres of ground. Within this imposing building are the two chambers occupied by the Senate and the House of Representatives, and apartments for the various committees and officials who meet at the Capitol, and other rooms, made necessary by the great amount of business transacted there. The rotunda, the marble stairways and the dome are decorated with choice statuary and paintings by famous American artists. Most of the paintings depict great events in the nation's history. The famous doors, designed by Randolph Rogers, which guard the east entrance, are ornamented in high relief with historic scenes from the life of Columbus. The old Hall of Representatives is now called Statuary Hall. See STATUARY HALL.

To the north, and in a space adjoining the Capitol grounds, is a massive granite building, in which are located offices for the Senators, and to the south are two other buildings of white marble, which contain offices for the members of the House of Representatives. These great structures constitute a notable contribution to the splendid group of buildings which crown Capitol Hill.

Along the Mall are the buildings of the Fish Commission, the Medical Museum, the great National Museum, the Smithsonian Institution, the Agricultural Department and the Bureau of Engraving and Printing. The buildings on the north side of the Mall include those of the Commerce Department, the Interstate Commerce Commission. the Post Office Department, Internal Revenue and others. East of the White House is the low, massive Treasury Department building, while west of it rises the magnificent building of the State, War and Navy Departments. The government Printing Office, the Pension Office and the Interior Department are in different localities of the North West quarter. Near the Capitol, and east of it, is the Library of Congress. (See LIBRARY OF CONGRESS). The new Supreme Court building faces the Capitol on the east.

The Lincoln Memorial (1922), an imposing marble temple with Doric columns, is situated on the bank of the Potomac at the west end of the Mall; within is the colossal statue of Lincoln by Daniel Chester French. At this point the beautiful Memorial Bridge reaches across the Potomac to Arlington Cemetery.

The Navy Yard, the Arsenal and the War College occupy sites on the river at the south side of the city. Other buildings widely famous are the Corcoran Art Gallery, the Pan-American Union building, the Scottish Rite Temple, the Freer Gallery of Art, the National Academy of Sciences, the United States Chamber of Commerce building and the home of the National Geographic Society.

The Municipal Center is at John Marshall Place, north of Pennsylvania Avenue. The old Supreme Court building is the center of the group which includes accommodations for the municipal court, the police court, the recorder of deeds, the administration office of the District, offices of the public library and the Board of Education. The new buildings are limited to six stories in height.

Religious denominations have done their share in adding distinction to the city. Among famous church buildings is the Protestant Episcopal Cathedral of Saint Peter and Saint Paul. The project resulting in this magnificent structure was begun in 1891. It will be completed as funds are provided but is now so far advanced as to be a national shrine. It is situated on Mt. Saint Albans on a plot of 67 acres. The ground floor will accommodate 27,000 persons standing. It is built chiefly on Indiana limestone. Several institutions are housed in this edifice.

In the National Shrine of the Immaculate Conception, the dome is a distinctive architectural feature; there is also a triple apse with each part divided into five chapels. The Methodist Episcopal Church South, near Mount Vernon Square, cost $500,000. The

Baptist Memorial Church represents both the Northern and the Southern Baptists. President Lincoln worshipped at the famous New York Avenue Presbyterian Church.

The colored people own many churches in Washington, including the famous Asbury Memorial.

Government of the Capital City. The city boundary is that of the District of Columbia; Congress governs the District through a commission appointed by the President. Government influences dominate all of the city's interests.

Residents in the District of Columbia even though citizens of the United States have no right of suffrage. It is left to voluntary organizations to consolidate public opinion in any effort to influence Congress in respect to civic affairs.

Educational Institutions. This is a great educational center. The public schools are excellent; the system was founded by a board of trustees of which Thomas Jefferson was the first president. Among the higher institutions of learning are Georgetown University, George Washington University, Catholic University of America, American University, National University, and Howard University. More than 150 high-grade private boarding schools and special schools give undergraduate instruction.

Supplementing the universities are the great scientific bureaus and institutions for research maintained by the government: these deal with problems of labor, education, fisheries, geological survey, health, scientific standards, forest conservation, weather and soil fertility. In fact there is scarcely a scientific area that is not investigated by government officials. There are 200 specialized libraries, some of them having large collections of valuable books.

The Smithsonian Institution, founded by James Smithson, an Englishman, who gave half a million dollars for its establishment, and the more recent Carnegie Institution, with an endowment of $10,000,000, are the leading private foundations for the advancement of knowledge.

History. Washington enjoys the distinction of having been designed and built for the capital of a great nation. Rome, London, Paris and Berlin grew out of the national conditions surrounding them and became the capitals of great empires, but the capital of the United States was located in a region sparsely populated and almost wholly wild; it was built from plans that were created before any city was in existence there. The site was selected by the great President whose name was given the city, and he watched over its early days with a personal care and interest.

Congress held its first session in the Capitol in 1800. The city grew until 1814, when, after a weak resistance by American troops at Bladensburg, it was captured by the British, who set fire to the public buildings and some private residences, with the expectation of destroying the entire city. A storm put out the conflagration, and the next day the British, in a panic of unnecessary fear, retreated, leaving Washington to be immediately rebuilt. At the breaking out of the Civil War it contained about 61,000 inhabitants. Beginning about 1900, following plans and designs by eminent architects and artists, vast improvements have been made in the appearance of the buildings erected by the Federal Government, especially in the section between the Capitol and the White House.

Related Articles. Consult the following titles for additional information:

Corcoran Art Gallery
District of Columbia
Library of Congress
Mount Vernon
National Museum
Potomac River
Smithsonian Institution
Washington Monument
White House

WASHINGTON, Booker Taliaferro (about 1858–1915), an American Negro educator. Freed from slavery by the Civil War, he began work in a salt furnace in West Virginia, attended a night school and obtained the rudiments of an education. He then went to Hampton Normal and Agricultural Institute, where he remained three years. After this he took a complete course at Wayland Seminary in Washington, D. C., and then became an instructor at Hampton, in charge of the work of the Indian pupils and of the night school.

His success was phenomenal, and in 1881 he was selected by General Armstrong, principal of the institute, to start a normal school at Tuskegee, Ala. He began his work in an old buiding, with thirty pupils, but in the course of the year purchased the plantation where the Tuskegee Institute is now located. Under his management this school developed into the largest and most influential industrial school for colored people in the world. See Hampton Institute; Tuskegee Institute.

He wrote *The Future of the American Negro, Up from Slavery* (his autobiography), *Character Building, The Story of My Life* and *Working with the Hands.*

WASHINGTON, George (1732-1799), an American soldier and statesman, the hero of American independence, and the first President of the nation which he helped to establish. There are two Americans of the generations now past who have won the undying love and reverence of their countrymen—Washington and Lincoln. Though they are equally honored, the one as founder and the other as preserver of the American nation, they are thought of as totally different types. Lincoln, so much nearer our own time, is by far the more human figure. His humanity, his rugged appearance, his humor and his kindliness are remembered as the characteristics of a very real man. Washington is more or less of a mythical personage. The idealized portrait painted by Charles Stuart, reproduced herewith in full page is in a way symbolic of the impression that Americans cherish of the "Father of His Country." He seems to them a lofty figure somewhat detached from everyday life; a great man, but one aloof from his fellowmen; a strong man, but without fire and vigor. The complete record of his life refutes these ideas. There is every reason to believe that if he were alive today he would be a virile and influential figure in American political affairs, a personality as vivid as in his own time.

Ancestry and Youth. The family of the first President came of a line of well-born Englishmen. They were the Washingtons of Sulgrave Manor, in Northamptonshire, who traced their ancestry to a Norman knight of the twelfth century. About the year 1657 John and Lawrence Washington, brothers, emigrated to America, and shortly afterwards purchased estates in Westmoreland County, Virginia. The eldest son of John was Lawrence Washington, the grandfather of the future President. His second son, Augustine, married Mary Ball as his second wife. Their first child, George, was born on February 22 (Old Calendar, 11th), 1732, at Bridges Creek, now Wakefield, in Westmoreland County. When George was three years old his parents removed to an estate on the Rappahannock River, in Stafford County, and there the boy's first school days were spent. George had as his first teacher the sexton of the parish. Under this man's guidance he learned to read and write.

At the age of eleven George lost his father, and his widowed mother sent him to the old homestead at Bridges Creek to live with his half brother, Augustine. There he attended school until he was nearly sixteen, geometry and surveying being included in his studies. While he was not an apt classical student, he made excellent progress in surveying, and throughout this school period he cultivated robust health by outdoor exercise, such as horseback riding and athletic games. It was when he was thirteen that he copied those rules of good behavior now so well known.

Soon after he left school George went to live with his eldest half brother, Lawrence, who was occupying that portion of the estate known as Mount Vernon. Lawrence Washington had married the daughter of William Fairfax, who was the manager of the great estate of his cousin, Lord Fairfax, the head of the family. Lord Fairfax conceived a great liking for young Washington, and presently entrusted to him the task of marking out the boundaries of the Fairfax estate. George began his duties in 1748, when he was but a few days past sixteen, and for many months he endured the hardships of a surveyor in the wilderness. His work was so well done that he was subsequently appointed public surveyor of Culpeper County, and his surveys were considered admirable examples of thoroughness and accuracy.

In 1751 George accompanied his brother Lawrence on a trip to the West Indies. The journey was undertaken in the hope of restoring the elder brother's health, undermined by service in the British navy. In 1752, a few months after the brothers returned to Virginia, Lawrence died, and George found himself the guardian of his niece and one of the executors of the estate. The death of this niece a few years later made him master of the Mount Vernon that is now cherished by all patriotic Americans. In later years, Washington enlarged the estate.

Early Military Career. Not long before he died Lawrence Washington had used his influence to have his brother appointed an adjutant-general over one of the several military districts into which Virginia colony was divided. This division was rendered necessary by the threatened encroachments of the Indians and of the French, who were establishing posts along the Ohio. Washington's eager pursuit of the study of military tactics was interrupted by the trip to the West Indies, but he resumed his duties as adjutant-general after his return, and late in 1753 was requested by Governor Dinwiddie to carry a message of warning to the French forces in the Ohio Valley. It was a hazardous mission for a young man of twenty-one, and the selection reflects favorably upon Washington's reputation for reliability and good judgment. In November, accompanied by an experienced frontiersman, he started on his 600-mile journey. After many narrow escapes from the Indians and the perils of the wilderness, he completed his mission and reported to Governor Dinwiddie on January 16, 1754, at Williamsburg, the capital of Virginia. Shortly afterwards he was appointed lieutenant-colonel of the Virginia regiment.

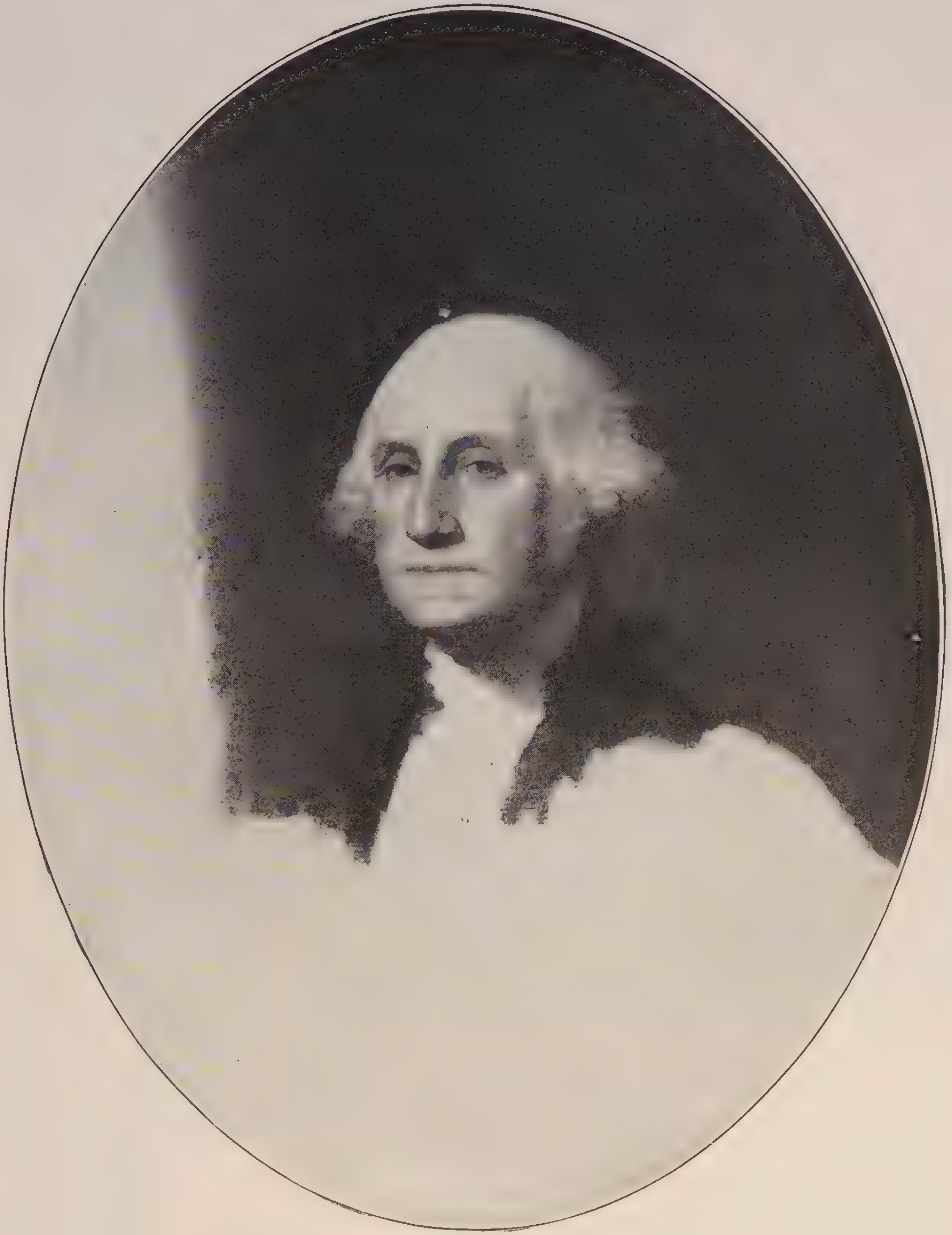
A skirmish with the French in the summer of 1754, which was not decisive, was followed by a reorganization of the Virginia troops and Washington's temporary retirement from things military. Early in 1755, however, General Braddock arrived from England with two regiments of British regulars, and offered the young colonial a place on his staff, with the rank of colonel. Promptly accepting, Washington entered eagerly into the preparation of the campaign, and on July 9 took part in the disastrous fight at Fort Duquesne. How the English regulars were mowed down by bullets fired from behind trees, and how the Virginians under Washington saved the little army from annihilation by fighting under cover, as did the French and Indians, is known to every American school boy. The troops succeeded in withdrawing from the field, but Braddock was fatally wounded, and died four days later. Washington later reorganized the colonial troops and was their chief commander until 1758, when he retired to Mount Vernon to rest. It was with great satisfaction, however, that, in November, 1758, he accompanied the British forces to the smoking ruins of Fort Duquesne, which was renamed Fort Pitt in honor of England's great Prime Minister.

At Mount Vernon. The period between the close of the French and Indian War and the outbreak of the Revolution brought to Washington some of the happiest years of his life. In January, 1759, he married Mrs. Martha Custis, an attractive and wealthy young widow with two children, John and Martha Parke Custis. The management of his own and his wife's property provided an outlet for his business instincts, and he entered whole-heartedly into the public affairs of Virginia colony as a delegate to the House of Burgesses, to which he had been elected before his marriage. These duties, with those of a good churchman and a hospitable colonial gentleman, rounded out a life completely wholesome and happy. The Mount Vernon mansion was always filled to overflowing during the hunting season, but none of its inmates enjoyed the pleasures of the chase more than the master himself.

As relations grew strained between the colonies and the mother country, Washington for a long time hoped that an agreement might be reached without resort to war, and he was very guarded in his utterances. In 1769, however, he drew up a nonimportation agreement which was adopted by the House of Burgesses, and from that time on he refused to permit any of the banned articles to be brought into his house.

As a member of the provincial convention, held in August, 1774, at Williamsburg, he vigorously upheld the right of the colonies to govern themselves, and, moved by reports about the effects of the Boston Port Bill, exclaimed in an impassioned speech, "I will raise a thousand men and march with them, at their head, for the relief of Boston." Virginia sent him as one of its six delegates to the First Continental Congress, and in this and the succeeding Congress, held in 1775, he made his influence felt through his personal contacts with individuals.

The Revolutionary War. On June 15, 1775, two months after the Battle of Lexington, Washington was unanimously chosen by Congress to be commander in chief of the Continental forces. Addressing the assembly the following day, he modestly accepted the honor, and assured the delegates that he would expect no remuneration except for his own expenses. He then departed on horseback for Boston, and on July 3, 1775, took command of the Continental army, in Cambridge. The old elm under which this cere-



GEORGE WASHINGTON
The unfinished portrait by Gilbert Stuart in the Athenaeum, Boston

WASHINGTON'S TOMB

In this family vault at Mount Vernon rest the bodies of George and Martha Washington.

Brown Bros.; Va. State Chamber of Commerce; Art Institute of Chicago

MOUNT VERNON AND ITS MASTER

Mount Vernon, the home of George Washington, situated on the Potomac River near Alexandria, Va., is maintained as a national shrine. Right: Houdon's statue of Washington.

mony took place was long preserved as a cherished relic.

The military events of the long struggle which the colonies waged for independence are told in these volumes in the article on the Revolutionary War. The personal share of Washington in the hard-won victory cannot be overestimated; from the perspective of a century and a half it seems almost incredible that he did succeed. Difficulties beset him that would have broken the courage of a weaker man. His little army of barely 14,000 was lacking in arms, supplies, discipline and organization. There was no uniform policy among the colonies on any matters essential to the prosecution of the war, and authority was vested in too many officials and organizations to bring about any semblance of unity. There were bickerings, quarrels and plots. Yet, somehow, Washington overrode all obstacles. For one thing, he was loved and trusted by his men, and because of that trust they endured terrible hardships to uphold him.

When the army went into winter quarters at Valley Forge, in December, 1777, Washington informed Congress that he had 2,898 men unfit for duty because they were "barefooted and otherwise naked." It is a matter of record that blood in the snow marked the path of those unshod troops as they marched into camp.

As a military leader Washington was superior to any of the field commanders sent over by England. In fact, his tactics in the movements on the Delaware River were characterized by Frederick the Great as the "most brilliant achievements recorded in military annals." Years later the old Prussian soldier sent his portrait to Washington, with this message: "From the oldest general in Europe to the greatest general in the world."

Coupled with his genius as a soldier was an abiding faith in the justice and ultimate triumph of the American cause. Toward the close of the struggle a movement was started to have Washington assume the title of king, but his repudiation of such a course was voiced in language as vigorous as he could make it. His great popularity never undermined his modest sense of his own worth or his deep-rooted conviction that the American nation was destined to be a democracy in which kings could have no part.

On November 2, 1783, he took final leave of his faithful army, and the following December appeared before Congress to resign the commission tendered him over seven years before. He said:

> Having now finished the work assigned me, I retire from the great theatre of action, and, bidding an affectionate farewell to this august body, under whose orders I have long acted, I here offer my commission, and take my leave of all employments of public life." "You retire," replied the president of Congress, "from the theatre of action with the blessings of your fellow-citizens; but the glory of your virtues will not terminate with your military command: it will continue to animate remotest ages."

On Christmas Eve Washington arrived at Mount Vernon, where, during the interval before the organization of the government under the Constitution, he enjoyed once more the life of plantation owner and private citizen.

The Constitution and the First Administration. Five years after the signing of the peace treaty a new crisis called Washington again into public life. Under the Articles of Confederation affairs were steadily growing more chaotic, and in May, 1787, a convention was called to meet in Philadelphia to prepare a new form of union. To this body Washington was sent as head of the Virginia delegation; on its organization he was unanimously elected its president. In September the convention completed a new Constitution and gave it to the states for ratification. The influence that Washington exercised in the consummation of this great achievement is ably summarized in Woodrow Wilson's *History of the American People*:

> "It gave the convention great dignity that Washington had presided over its counsels and was heart and soul for the adoption of the measures it proposed. His name and quiet force had steadied the convention on many an anxious day when disagreement threatened hopeless breach. His fame and influence infinitely strengthened also the measures proposed, now that they were completed. He supported them because they were thoroughgoing and courageous and cut to the root of the difficulties under which the country was laboring. Issue had been joined now, as he had wished to see it joined, between government or no government, and the country was to know at last where it stood in the most essential matters of its life."

It is not surprising that when the votes of the first Electoral College were counted it was found that Washington was the unanimous choice for President of the United States. John Adams was honored with the Vice-Presidency.

Washington was inaugurated in New York, which was then the national seat of government. Standing on the balcony in front of the old Federal Hall, whose site is now occupied by the imposing Subtreasury, he took the oath of office on April 30, 1789, though the legal day for the ceremony was March 4. Difficulties in setting the new machinery in motion were responsible for the delay.

From the first he displayed in civil affairs the same qualities of leadership and invariable good judgment which he had shown during his military career. He set about informing himself concerning all that had happened during the period of the Confederation—the relations of the new government to foreign nations, and the questions of internal administration and finance, which were soon to become pressing issues. He also chose a remarkably strong Cabinet, including Thomas Jefferson and Alexander Hamilton, who, though directly opposite in their political opinions, were acknowledged leaders in the political life of the country.

The selection of Alexander Hamilton as head of the Treasury Department was momentous in its results, for through his farseeing statesmanship the country was put on a sound financial basis. In accordance with Hamilton's program the national government assumed the debts of the states incurred during the war; a national bank and a mint were established; and a national income was provided for by duties on imports and a system of internal revenue.

Other important events of the first four years under the Federal Constitution were the organization of the United States Supreme Court, the admission of Vermont (1791) and Kentucky (1792) as states, the adoption of a decimal system of coinage, and the incorporation into the Constitution of the first ten amendments. So profoundly impressed were the people with the results of Washington's first term that there was a spontaneous demand that he serve again. Against his personal wishes he consented, and was unanimously reëlected, being inaugurated in Philadelphia on March 4, 1793. The city of Washington did not become the national capital until 1800.

The Second Term. During this term international affairs for a time overshadowed domestic issues. A war between France and England vastly aroused the sympathies of a group friendly to France, and there were some extremists who demanded that the nation go to its assistance. Another faction as vehemently urged neutrality or support for England. Washington, who saw clearly that the United States was too weak and insecure to be implicated in European quarrels, issued a proclamation of neutrality and refused to take sides. An unfortunate incident of this affair was the activity of Edmond, or "Citizen," Genet, a Frenchman whose defiance of the proclamation caused the government considerable anxiety. The French sympathizers were also greatly exercised over the acceptance of the Jay Treaty (1794) with England. This treaty was not so favorable to America as its sponsors wished, but it was the best that could be obtained, and it served the purpose of averting war with England, which Washington felt would be a national calamity.

The power of the Federal government was vigorously exercised in this administration. In Pennsylvania in 1794 there occurred an insurrection in protest against the excise tax, to quell which Washington ordered out 15,000 militia. Trouble with the Indians was settled by Anthony Wayne's victory over them at Fallen Timbers in 1794 and by the negotiation of treaties. Other events include the invention of the cotton gin by Eli Whitney; the erection of the first woolen mill in Massachusetts; the admission of Tennessee into the Union, and the development of two great political parties, by followers of Hamilton and Jefferson, respectively.

The End of the Story. Washington declined a third election, delivered his famous farewell address and retired to Mount Vernon in 1797. Thereafter he devoted himself to agriculture, though in 1798, at the prospect of the war with France, he was chosen commander in chief of the United States army and accepted, though he was not called into the field. He died in December, 1799, from illness brought on by long exposure in the saddle. The news caused almost as widespread mourning in Europe as in America. The greatest statesmen and soldiers of every nation united in paying him tribute as a man, general, statesman and friend of humanity. The words of his old friend and companion, "Lighthorse Harry" Lee, "First in war, first in peace and first in the hearts of his countrymen," were without question literally true. He had avoided the snares of factional and partisan politics, had generously overlooked

Administration of George Washington, 1789-1797

- I. ELECTION AND INAUGURATION
- II. THE PRESIDENT
  - (1) Birth
  - (2) Ancestry
  - (3) Education
  - (4) Previous public career
  - (5) Character
  - (6) Rank as a statesman
  - (7) Death
- III. ORGANIZATION OF THE GOVERNMENT
  - (1) Strict and loose constructionists
    - (a) Followers of Hamilton
    - (b) Followers of Jefferson
  - (2) Executive departments
    - (a) State
    - (b) Treasury
    - (c) War
    - (d) Attorney-General
  - (3) Federal courts established, 1789
  - (4) Financial measures
    - (a) The public debt
    - (b) The excise, 1791
    - (c) Bank of the United States
    - (d) The Mint
    - (e) Tariff on imports, 1789
- IV. DOMESTIC AFFAIRS
  - (1) Governmental
    - (a) Last state ratifies the Constitution
    - (b) Census of 1790
    - (c) Whisky Insurrection, 1794
    - (d) Admission of Vermont, Kentucky, Tennessee
    - (e) Site of Washington chosen
    - (f) Ten Amendments
    - (g) Campaigns against the Indians
  - (2) General
    - (a) Invention of cotton gin
    - (b) Death of Franklin
    - (c) Slavery
    - (d) Settlement of Northwest Territory
- V. FOREIGN AFFAIRS
  - (1) Genet and quarrel with France
  - (2) Jay Treaty
  - (3) Treaty with Spain
    - (a) Opened the Mississippi
    - (b) Florida boundary
- VI. ELECTION OF 1796
  - (1) Political parties
    - (a) Federalists
    - (b) Republicans
  - (2) Candidates
    - (a) John Adams
    - (b) Thomas Pinckney
    - (c) Thomas Jefferson
    - (d) Aaron Burr
  - (3) Election of Adams

Questions on Washington

Where was Washington at the time of his election to the Presidency?

Where was he inaugurated?

What city was the capital during most of his administration?

How does he rank as a soldier and statesman?

In what way did Hamilton's ideas influence the organization of the government?

What were the original executive departments?

Was the Attorney-General the head of a department?

Who were the members of the first Cabinet?

When were the Federal courts established?

What compromise was necessary before Hamilton could secure the assumption of the state debts?

When was the Bank of the United States organized?

What were some of its powers?

When was the first tariff law passed?

What was its primary object?

When was the first census taken?

What states were admitted during Washington's term of office?

What caused the trouble with the Indians in the Northwest?

What battles were fought and with what result?

What party was friendly to France? Why?

Give an account of Genet's visit to the United States.

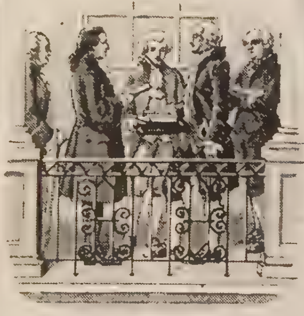
What was the Jay Treaty? What did it accomplish?

THE ADMINISTRATION OF
GEORGE WASHINGTON

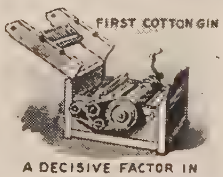
FIRST PRESIDENT OF THE UNITED STATES—1789 to 1797

DIFFICULT ROADS MADE LIFE HARDER

FIRST UNITED STATES BANK CHARTERED 1791

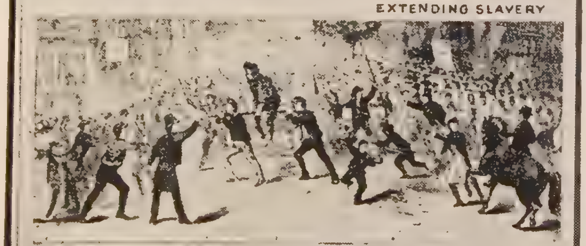


FIRST INAUGURATION - APRIL 30th, 1789

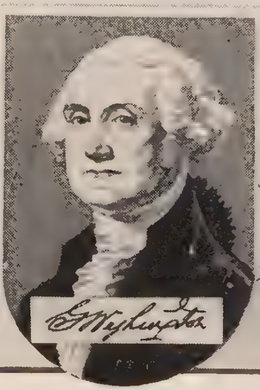


FIRST COTTON GIN

A DECISIVE FACTOR IN EXTENDING SLAVERY



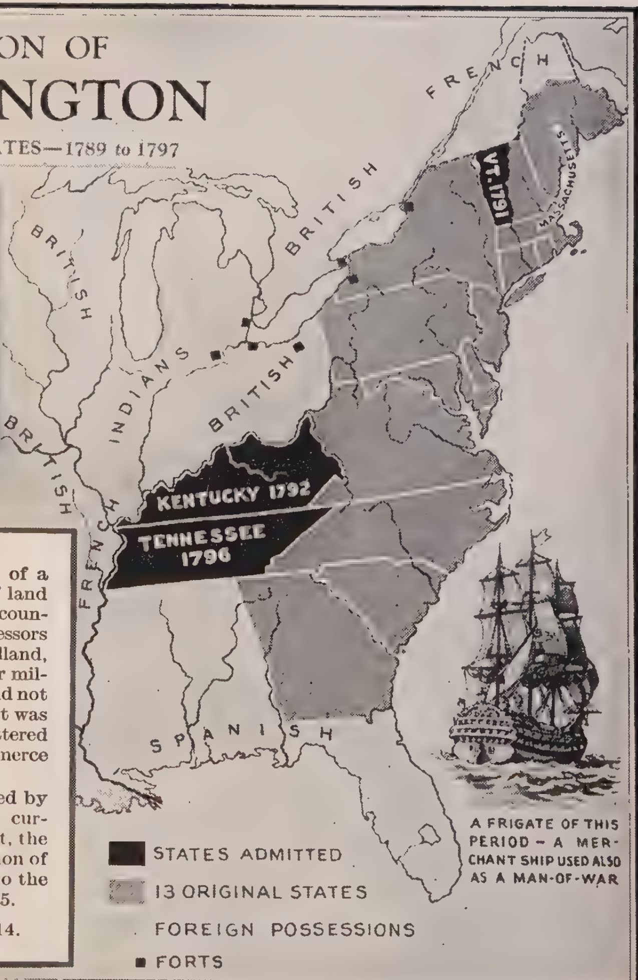
THE WHISKY REBELLION PROTESTED FEDERAL TAXES



Here are the meagre beginnings of a new nation: (1) a narrow strip of land along the Atlantic seaboard; (2) a country menaced by such foreign aggressors as England, France, Spain and Holland, and the Indians; (3) less than four million inhabitants, many of whom did not fully believe in the new venture. It was a rural country, with a few scattered factories, where land and commerce were the chief sources of wealth.

The new government was braced by Hamilton's plan for a national currency, a tariff system, public credit, the First U. S. Bank and the assumption of state debts. Eleven amendments to the Constitution were ratified by 1795.

POPULATION, 1790, 3,929,214.



A FRIGATE OF THIS PERIOD - A MERCHANT SHIP USED ALSO AS A MAN-OF-WAR the harshest criticisms and had respected and used the abilities of his severest critics and opponents. Though a slave-holder at his death, he was in favor of the gradual abolition of slavery by legislation, and by his will he arranged that his one hundred twenty-five slaves should be emancipated at the death of his wife, so that the Negroes of the two estates who had intermarried might not be separated. Washington's body and that of his wife, who survived him nearly three years, rest in the family vault at Mount Vernon.

Consult Lodge's *George Washington*, in the American Statesmen Series, and Fiske's *Washington and His Country*, a condensed and simplified edition of Washington Irving's *Life of Washington*.

Related Articles. Consult the following titles for additional information:

Braddock, Edward
Constitution
French and Indian Wars
Genet, Edmond C.
Jay Treaty
Mount Vernon
Political Parties in the United States
Tariff
Revolutionary War
United States
Whisky Insurrection

WASHINGTON, Martha (1732-1802), the wife of George Washington, born in New Kent County, Va., the daughter of John Dandridge, a wealthy planter. Her first husband, to whom she was married in 1749, was Daniel Parke Custis. She was married to George Washington in 1759. As mistress of the White House she won a firm place in the hearts of the people. She died at Mount Vernon two years and a half after the death of President Washington.

WASHINGTON, Pa., the county seat of Washington County, situated thirty-two miles southwest of Pittsburgh, on the Pennsylvania and the Baltimore & Ohio railroads. It is the seat of the Washington and Jefferson College, the oldest college west of the Alleghenies, and also of the Washington Seminary. Washington is said to have erected the first crematory in the United States. Bituminous coal and natural gas are produced in the vicinity. The manufacture of glass products is the chief industry; other products include fine steel, clay products, ferro alloys and iron castings. The vicinity of Washington was settled in 1768. The town was founded in 1781 by David Hoge, receiving its present name in 1784. It was incorporated as a borough in 1810 and as a city in 1924. Population, about 26,000.

WASHINGTON, Treaty of, the treaty between the United States and Great Britain, signed in 1871, providing for the settlement of several difficulties between the two countries, chief of which were the Alabama claims. A commission, which consisted of five representatives of Great Britain, headed by Earl de Grey and Sir John MacDonald, and five representatives of the United States, headed by Hamilton Fish and E. R. Hoar, began its meetings May 8 at Washington. It referred the Alabama Claims to a special court, which was to meet at Geneva (see Alabama, The; Geneva Arbitration). It provided for the establishment of a mixed commission to discuss and decide upon the northwestern fisheries question, and it submitted the northwest boundary dispute to the arbitration of the emperor of Germany. It also laid down certain rules regarding neutrality in war, which were to govern the Geneva Tribunal in deciding the Alabama question and which have since been considered the true principles of international law upon the subject.

WASHINGTON, University of, a coeducational state institution founded at Seattle. It was organized in 1861, but the regular four years' courses were not established until 1877. In 1889 it became the state university, as Washington entered the Union that year. It maintains the College of Arts and Sciences, which includes about ten semi-professional schools; the colleges of Economics and Business, Education, Engineering, Forestry, Mines and Pharmacy; the Graduate School, and the School of Law. The university has a faculty of about 560, and over 12,000 students in regular session. The libraries contain almost 469,000 volumes.

WASHINGTON AND LEE UNIVERSITY, an institution for men only located at Lexington, Va. It was established as the Augusta Academy in 1749 and afterwards renamed Washington Academy in recognition of a gift of money made to the institution by the "Father of his Country." This gift still yields an annual income of $3,000. In 1865 General Robert E. Lee was made president of the institution, a position which he held with great influence upon the students until his death in 1870. In 1871 the present name of the institution was adopted. The university has a Liberal Arts College, a School of Commerce and Administration and a School of Law; it offers B. A., B. S. and LL. B. degrees. It has a faculty of sixty-five members, about 925 students and property and endowments aggregating $5,000,000.

WASHINGTON ARCH, a beautiful memorial structure, erected to commemorate the first inauguration of George Washington as President of the United States. It stands at the foot of Fifth Avenue, New York, and was designed by Stanford White. It is of marble, seventy-seven feet high and sixty-two feet broad, with a single archway forty-seven feet high and thirty feet broad. Its cost of $128,000 was met by popular subscription.

WASHINGTON ELM, a famous elm, formerly standing near the northwest corner of the Common, in Cambridge, Mass. Near the base was a stone seat with the inscription: "Under this tree Washington took the command of the American Army July 3, 1775." Although carefully protected, the tree fell to the ground October 26, 1923.

WASHINGTON MONUMENT, an imposing marble obelisk in Washington, D. C., measuring 555 feet in height. It is situated in the Monument Gardens, south of the White House. It was begun in 1848, but was not dedicated until 1885, on Washington's birthday. The top, from which a magnificent view of the surrounding country is obtained, is reached by an elevator and by a wide, concrete interior stairway. The monument weighs over 43,600 tons and it cost $1,187,710.

WASHINGTON UNIVERSITY, a coeducational school at Saint Louis, Mo., founded in 1853 by Dr. William Greenleaf Eliot, on condition that it be kept nonsectarian and nonpartisan. Its activities were carried on in different parts of the city till 1905, when all were removed to the present location west of Forest Park. Ten new granite buildings on this site were occupied by the Louisiana Purchase Exposition in 1904. The departments of the university include those of liberal arts, engineering, architecture, business, law, medicine, dentistry, nursing, fine arts, evening classes, graduate school and summer school. The faculty numbers over 800; there are about 9,000 students. The library contains 300,000 volumes.

WASHITA, *wosh'e tah*, **RIVER**, or **OUACHITA RIVER**, a river that rises in the western part of Arkansas, flows southeast and then south into Louisiana and discharges into the Red River, about fifteen miles above the confluence of that stream with the Mississippi. The Washita is connected with the Mississippi by a series of bayous. Its length is 550 miles, and it is navigable for steamboats for about 350 miles.

WASP, *wahsp*, a winged insect resembling the bee in many respects. The body is bluish in color, with yellow markings, or black, marked with white or yellow. Common wasps live in societies, or colonies, composed of males, females and workers, or neuters (see BEE). The females are armed with an extremely powerful and venomous sting; the males do not sting.

The nest of the wasp is ingenious, both in material and construction. It is built in the ground or attached to a wall or tree, and is composed of a kind of chewed wood pulp or paper manufactured by the females. Within these nests the combs are enclosed completely, except for the small opening where the wasps enter. The cells of the comb, in which the larvae and pupae are reared, are six-sided and arranged in tiers, with the mouth downward or sidewise.

Wasp colonies multiply rapidly, and have been known to attain to 30,000 members in a favorable summer season. But in the fall all the members perish except a few females, which pass the winter under stones or in hollow trees. Wasps are voracious insects, living upon sugar, meat, fruit, honey or the juices of other insects. Certain species live solitary lives, each mother making its own nest and caring for its own eggs and larvae.

WATAU'GA ASSOCIATION, in American history a name given to an association of settlers, formed in 1772, in the eastern part of what is now Tennessee, just west of the Alleghany Mountains. Articles were drawn up for the purpose of creating a government for the district, and provision was made for five executive councilors, thirteen legislators, a sheriff and an attorney. The government had no jurisdiction over any but the signers of the compact, and the territory soon swarmed with outlaws and adventurers. In order to secure protection, the community, under the name of Washington District, asked for and secured representation in the North Carolina Assembly.

WATCH, a small, portable mechanism for measuring time, having about the same number of wheels as a clock, geared in the same manner, but differing from a clock in having a hairspring and a balance wheel, instead of a pendulum, and in having its parts much smaller and more delicately adjusted. It is attached to a chain and carried in the pocket, or to a bracelet and worn on the wrist

Mechanism. A watch consists of two parts, the case and the works. The case is of metal, usually gold or silver, and it is made with one or two covers. The works consist of two plates, perforated for the purpose of holding the wheels in position, and so arranged that they contain, between them, all of the wheels except the balance wheel. The lower plate, known as the pillar plate, rests next to the dial. The upper plate may be in one or in several pieces, but in the best-made watches it is usually in one piece. These plates are bored and chiseled so that each wheel fits perfectly into its place. The perforations, in which the minute axles of the wheels rest, are usually set in jewels, which prevent wear. There are four wheels in the watch; these are (1) the barrel wheel, within which the mainspring is attached, (2) the first wheel, (3) the second wheel and (4) the third wheel, which is attached to the pinion of the escapement wheel. The motion is imparted by the uncoiling of the spring and is regulated by the escapement, which is kept in operation by the action of the mainspring and the hairspring combined, the two giving it an oscillating movement. The wheel which meshes into the pinion of the escapement wheel revolves once a minute and has sixty teeth upon its circumference. The pinion of this wheel meshes into the circumference of the wheel which gives the motion to the minute hand, and this meshes into the pinion of the center wheel, which gives the motion to the hour hand. The watch is regulated by a lever device, connected with the hairspring. By moving this to the right, or left, the tension is lessened or strengthened.

Watch Making. The works of a watch have for their foundation two plates of an alloy of brass and nickel. These plates are cut at the foundry, where the metal is cast, from dies furnished by the watch factory.

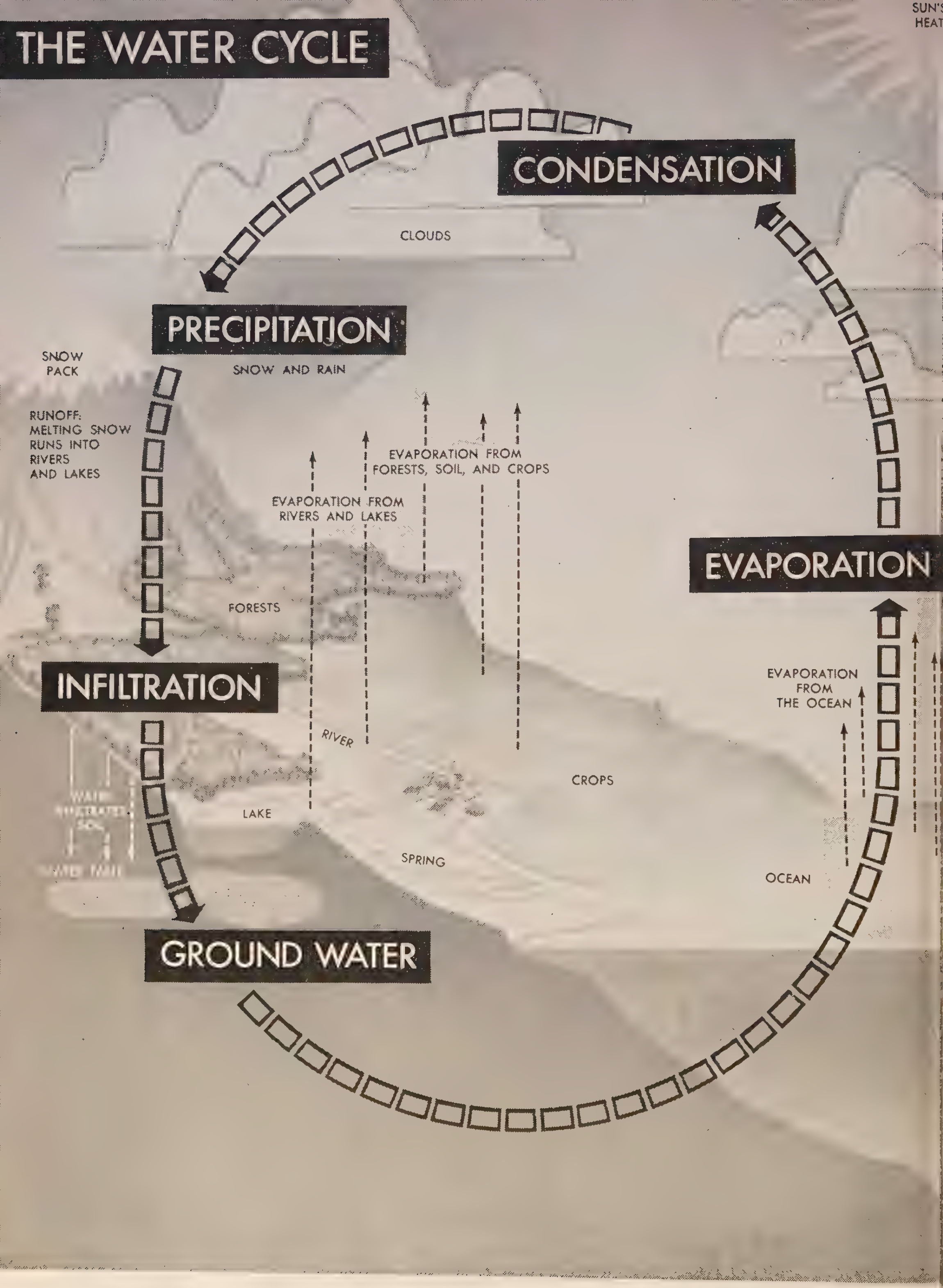
The rough plates are passed under trimming, or stripping, punches, which smooth off the roughness. Indentations absolutely exact are then made in the foundation plate, to allow room for the wheels. The plate is placed under the lathe portion of a machine, and a steel copy of what it is to be is fastened to another part. The machine follows the outline of the steel model, gradually cutting out the foundation plate, so that the various parts of the mechanism of the watch will be thrown into proper position. The thickness of the plate and the depth of the indentations are measured so as to be perfect, according to a gauge, two degrees of which equal the thousandth part of an inch. The necessary screw holes and apertures for the settings are then drilled into the plate. The work on the upper plate is done in the same manner. The plates are then polished and smoothed down, on an Ayr stone, a stone harder than a soapstone and softer than emery, capable of polishing without scratching.

The jewels used in watch making are garnets, rubies, sapphires and diamonds. Garnets are most common and are cut with diamond points into minute disks and then smoothed and pierced. These disks are set in larger disks of gold. The foundation plates are given an ordinary heavy plating of gold, by the battery process, and the jewels with their settings are fitted and fastened into the plate by exceedingly small screws.

The wheels of a watch are stamped out of sheets of brass, with the exception of one or two pieces. The screws and springs are made from sheet steel, the screws being cold-drawn from wire. In tempering some of the screws, the workman uses a thermometer of a peculiar sort, in order to regulate accurately the temperature to which they are to be heated and cooled. Others are regulated by a careful observation of their color. The figures are printed on the dial by a process resembling lithography (see LITHOGRAPHY). The base of the dial is of copper and is stamped out of a thin sheet of the metal, in such a manner that a rim is left turned up for a short distance all around. Powdered enamel is spread on the disk, and it is then fired, like pottery or china. Steel plates are engraved with the design to be executed, and the lines are filled with a mineral paint of the desired color. The plate is then passed under a roller, covered with sheet rubber, and the dial receives the impression from the rubber on the roller. It is again fired, and when fancy colors are employed, each color requires a separate impression and firing. The balance wheel requires forty different steps in its manufacture.

When all the parts are assembled, the watch is taken to a refrigerator and subjected to cold. This is followed by a period in a hot air compartment, the two tests ranging from 40° to 103° F. The making of

THE WATER CYCLE



THE CONTINUOUS EXCHANGE OF MOISTURE between the earth and the sky is called the water cycle, or hydrologic cycle. Water evaporates from the surface of the seas, from lakes, ponds, soil, and plants. It is carried upward on warm currents of air. Where a dry, cold continental air mass meets warm, moist maritime air, the water vapor condenses and falls to earth as rain or snow, and the cycle begins again. The sun is the "engine" that operates the water cycle.

watches by hand is thought to have originated in Germany about 1500. Peter Henle, a German locksmith, is given credit for having made the first watch. Watchmaking machinery was developed during the late nineteenth century. The United States and Switzerland are important watch-manufacturing countries. See also CLOCK.

WATER, the liquid that covers five-sevenths of the earth and is essential to all animal and vegetable life, is a chemical compound of hydrogen and oxygen in proportion of two atoms of the former to one of the latter. Its chemical symbol, therefore, is H_2O. Pure water is a colorless, tasteless, odorless liquid. It appears blue, like the atmosphere, when seen in mass.

Three Forms of Water. Water takes three forms, each depending upon temperature. It takes a solid form, that of ice or snow, at 32° Fahrenheit (0° Centigrade) and all lower temperatures; and it takes the form of vapor or steam at 212° F. (100° C.) under a pressure of 29.9 inches of mercury, and it retains that form at all higher temperatures. Under ordinary conditions, water possesses the liquid form only at temperatures lying between 32° and 212°. It is, however, possible to cool water very considerably below 32° F. and yet maintain it in the liquid form. Water may also be heated, under pressure in the laboratory, many degrees above 212° F., without passing into the state of steam.

The specific gravity of water is 1 at 39.2° F., (that is, one cubic centimeter of water weighs one gram), and it is the unit to which the specific gravities of all solids and liquids are referred, as a convenient standard; one cubic inch of water, at 62° F. and 29.9 inches barometrical pressure, weighs 252.458 grains. Distilled water is 815 times heavier than atmospheric air. Water is at its greatest density at 39.2° F. (4° C.), and in this respect it presents a singular exception to the general law of expansion by heat. If water at 39.2° F. be cooled, it expands as it cools, till reduced to 32°, when it solidifies; and if water at 39.2° F. be heated, it expands as the temperature increases, in accordance with the general law. Were it not for this peculiar property of water, ice would settle to the bottom of lakes and streams and they would become masses of solid ice, a condition which would soon destroy all life upon the earth.

So-called *heavy water* differs from ordinary water in having two atoms of heavy hydrogen and one atom of oxygen.

Water as a Solvent. From a chemical point of view, water is a neutral fluid and shows in itself neither acid nor basic properties; but it combines with both acids and bases, forming *hydrates,* and with neutral salts. Water also enters, as a liquid, into physical combination with the greater number of all known substances. Of all liquids, water is the most powerful and general solvent, and on this important property its use depends. In consequence of the great solvent power of water, it is never found pure in nature. Even in rain water, which is the purest, there are always traces of carbonic acid, ammonia and sea salt. Where the rain water has filtered through rocks and soils and reappears as spring or river water, it is always more or less charged with salts derived from the earth, such as sea salts, gypsum and chalk. When the proportion of these is small, the water is called *soft;* when larger, it is called *hard water.* The former dissolves soap better and is therefore preferred for washing; the latter is often pleasanter to drink. The only way to obtain perfectly pure water is to distill it, but matter simply held in suspension may be taken out by suitable filtration.

Sources of Water. The great reservoirs of water on the globe are the seas and lakes, which cover more than three-fifths of its surface, and from which water is raised by evaporation. Uniting with the air in the state of vapor, it is wafted over the earth, ready to be precipitated in the form of rain, snow or hail. Water, like air, is absolutely necessary to life, and healthy human life requires that it should be free from contamination; hence, an ample and pure water supply is considered as one of the first laws of sanitation.

Related Articles. Consult the following titles for additional information:

Boiling Point
Chemistry
Cloud
Dew
Distillation
Erosion
Evaporation
Freezing
Frost
Hail
Humidity
Hydrogen
Ice
Mineral Waters
Ocean
Rain
River
Snow
Spring
Steam
Vapor
Water Power
Water Purification

WATER, ORDEAL BY. See ORDEAL.

WATER BEETLE, any representative of several families of beetles which live in or upon the water. Three of the families include beetles which live permanently in water; the rest include those species which live in the water only in the larvae (young) stage.

The *diving beetle* has a flat, oval body, over which the wings fit tight. The hind legs, which have a fringe of hairs, are flattened and adapted to swimming; the front legs are short. The common *water beetle* seen in summer darting over the surface of ponds has a water-tight compartment beneath the close-fitting wings for the storage of breathing air. In the evening these beetles leave the water and fly about. The larvae, called *water tigers,* are exceedingly rapacious, seizing in their sickle-like jaws small fish, tadpoles and other larvae, from which they suck the juices. Breathing is effected through tubes terminating in the tail, which is raised above the surface of the water.

The *whirligig beetles,* so called from their habit of moving in circles on the water, have long, clawed front legs and shorter, paddle-shaped hind legs. The body has an oily surface unaffected by water, and the compound eyes are adapted for vision in water and in air. One of the largest of the water beetles is the glossy *black beetle,* often seen on the wing at night. These insects can be transferred to an indoor aquarium, and their whole interesting life history may be studied in the school room. See BEETLE.

WATER BUG, a name applied to any insect belonging to one of six large families, including *water striders, water boatmen, water scorpions, toad bugs* and *fishkillers.* All have flat bodies, and are equipped with oar-shaped legs for swimming. They may be seen on summer days darting over the surface of ponds and lagoons or resting quietly on the surface, their bodies being buoyed up by the air stored in various parts of the insects. If alarmed, they may dive to the bottom and cling to plants or stones. About a dozen species are found in America. Some of them leave the water and fly around lights at night; the electric light bug is one of these. Some of the adults lie dormant in the mud of water bottoms in winter; others hibernate in rubbish on the banks, and here the eggs are deposited. When the young hatch they tumble into the water and feed on insects and other small animal food. The females of some species bore holes in aquatic plants and deposit their eggs there. In the United States the *croton bug,* a house pest resembling the cockroach, is incorrectly called water bug, because it is usually seen on or near warm-water pipes.

WAT'ERBURY, CONN., one of the county seats of New Haven County, about thirty miles southwest of Hartford, on the Naugatuck River and on the New York, New Haven & Hartford Railroad. It is an important manufacturing center; it leads the United States in brass and copper goods, and for this reason is sometimes known as the "Brass City." The famous Waterbury watches and clocks have been manufactured here in immense numbers since 1879. Buttons and buckles, tools, heavy machinery, chemicals, clothing and other articles are also manufactured. Grandfather clocks were made here in the late eighteenth century.

The place was settled in 1677, as part of Farmington township, and was known by the Indian name of Mattatuck until its incorporation as the township of Waterbury in 1686. In 1691 it suffered from a flood; in 1712 an epidemic proved fatal to about one-tenth of the population, and in 1902 a large portion of the business section was destroyed by fire. Waterbury was chartered as a city in 1853. The township and city of Waterbury were consolidated in 1901, and now cover an area of twenty-eight square miles. The Mattatuck Historical Society museum contains many interesting historical exhibits. The government of the city is by mayor and council. Population, about 105,000.

WATER COLORS, pigments mixed and ground with gum size or some other adhesive substance, instead of oil. The water colors used in painting pictures are in the form of small, dry and hard cakes, while those used in coloring walls and the like are simply mixed up with glue or size. The quick drying of water colors is favorable to rapid execution, and a greater clearness and transparency is obtained than in an oil painting. Fresco, tempera, distemper, gouache and aquarelle (the modern method) are forms of water-color painting. See PAINTING.

WATER DOG. See MUD PUPPY.

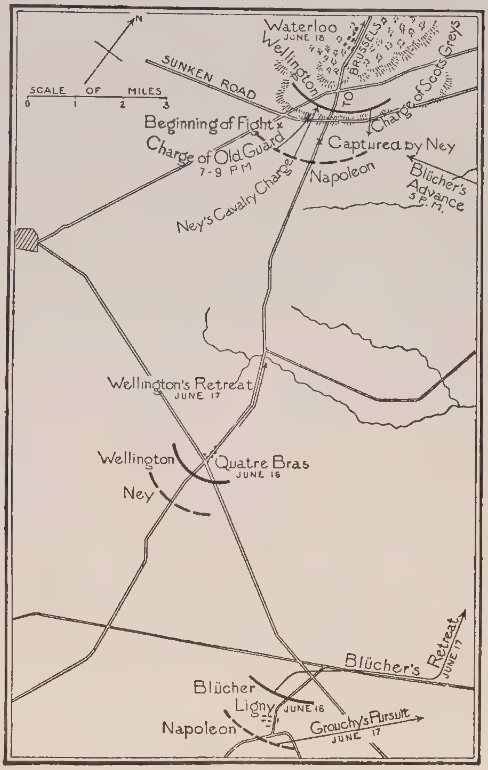
WATERFALL. See CATARACT.

WATER LILY, a water plant with a gorgeous blossom, found in quiet waters of the temperate and torrid zones. From the oozy bottom the stems rise to the top of the water; there the leaves open out and lie flat upon the surface, and the buds unfold, disclosing numerous petals, stamens and carpels. The flowers may be pink, white or blue, and sometimes they are very fragrant. The most famous of water lilies is the Queen Victoria, a native of South America. The leaves, six feet or more in diameter, are flat, with upturned rim, and are often strong enough to support a man's weight. The blossoms, a foot in diameter, open on two successive nights; the first night they are white and fragrant, the second, pink and malodorous.

The Australian water lily is often as large and is usually blue. The Egyptian lotus is also a blue lily, famous since remote antiquity. The American pond lily is a lovely, creamy-white flower, with petals radiating in circles and a cluster of golden stamens. It expands to the sunshine and closes at dusk. The golden lily of Florida is a handsome flower, and the common yellow water lily of higher latitudes is less showy, but blooms all summer. A rose-colored variety is also found in North America. The seeds of the pond lily lie sunk in pits in the flattened top of a hemispherical pod. Those of several species are edible, and are sometimes called *water chinquapin.* They were an important article of food among the Indians.

WATERLOO, Battle of, the famous battle, fought June 18, 1815, near Waterloo, a village in Belgium about eleven miles south of Brussels, between Napoleon and the allied forces under Blücher and Wellington. It was Napoleon's last battle, and it put an end to his power (see Hundred Days). There had been two preliminary battles on the 16th, one at Quatre-Bras, by which Ney, although forced to retire, prevented Wellington from joining his Prussian allies, and one at Ligny, in which the Prussians under Blücher were defeated by Napoleon. On the morning of the eighteenth the main French army was drawn up near Waterloo, opposite the allied British, Dutch and German forces, under Wellington. Blücher, with the Prussian army, was absent at the opening of the fight. The French army numbered about 72,000, the allied army about 67,000, of which number many were untrained troops.

Napoleon's plan was to defeat Wellington before Blücher could come up with his troops, but the ground was in such a condition from the rain that had fallen all night that he was obliged to delay opening battle until almost noon. Wellington, on the contrary, simply aimed to hold out until the Prussians arrived, when a combined attack might be made on the French. In accordance with these plans the struggle throughout the day consisted chiefly of charges, brilliant but unsuccessful, on the part of the French, and firm resistance on the part of the English. The French cavalry, charging during the afternoon, plunged into an unseen sunken road, and unable to check their rush, they filled the great ditch with troopers, over whom the remainder rode on. These repeated charges, although stubbornly resisted, had their effect, and the outcome of the battle remained doubtful until late in the day, when the arrival of the Prussians, at a time when both armies were about exhausted completely turned the tide against the French. Napoleon's last effort was the charge of the Old Guard, the picked veterans from the Imperial Guard, late in the evening. Its rout was complete, and many of its squares, refusing to surrender or retreat, fell to the last man. Wellington now gave the order for a general advance, and the French, utterly overpowered, gave way at every point. The army broke up in confusion, and the dis-



BATTLE OF WATERLOO

astrous retreat, with the Prussians in pursuit, lasted through the night. Napoleon himself escaped by flight. The French lost in this battle probably thirty-one thousand in killed, wounded and missing, while the allies lost over twenty-two thousand.

The importance of the Battle of Waterloo as the means of finally crushing Napoleon has been somewhat exaggerated. Even had he been successful on that day, he could never have regained his old power. But the accomplishment of his overthrow that early in his campaign was fortunate for the allies and for the French, as it saved further bloodshed. See NAPOLEON I.

WATERLOO′, IOWA, the fifth city in the state in size, is the county seat of Black Hawk County, on the Red Cedar River and on the Chicago, Rock Island & Pacific, the Illinois Central and the Chicago Great Western railroads. Waterloo is one of the leading industrial cities in the state, deriving its principal income from meat packing and the manufacturing of farm machinery. The city produces about twenty per cent of the farm-type gasoline engines made in the United States; it is also one of the five leading meat-packing cities in Iowa, and has important manufactures of tractors, cream separators and cement mixers, as well as other products. Waterloo is the distributing center for northeastern Iowa—a farming and livestock-raising region—and is the headquarters for the Dairy Cattle Congress and the International Belgian Horse Show. Repair shops of the Illinois Central Railroad are here.

The city was settled about 1846. It was laid out in 1854 and chartered in 1868. The government is by mayor and council. Population, about 65,000.

WATERLOO, ONT., on the Canadian National Ry., three miles northwest of Kitchener. It is an important center for manufacturing, furniture, boots and shoes, threshing machines, buttons, mattresses, washing machines, trunks and bags, bricks and tiles being the most important products. Niagara electric power is furnished to the factories. There are good public and separate schools and numerous churches. Population, 12,000.

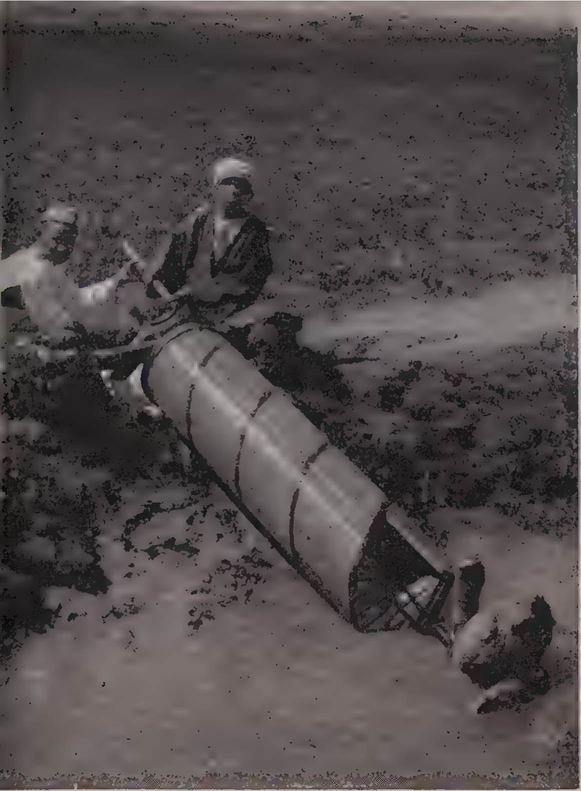
WATERMELON, a creeping variety of gourd. The rind of the fruit is smooth and dark green when ripe; the inside of the melon is a coarse red or yellowish pulp, ninety per cent of which is water. Its native home was Africa, but it has been widely cultivated from remote times. It is very popular in the United States, where it has become a most important crop for the fruit-growers of the South Atlantic and Gulf states, in which sections thousands of acres are devoted to raising melons for the northern market. Watermelons in smaller quantities are raised as far north as Southern Ontario. The ideal soil for melon culture is light, sandy loam, which is naturally dry or else thoroughly drained. Most melons weigh from twenty to fifty pounds.

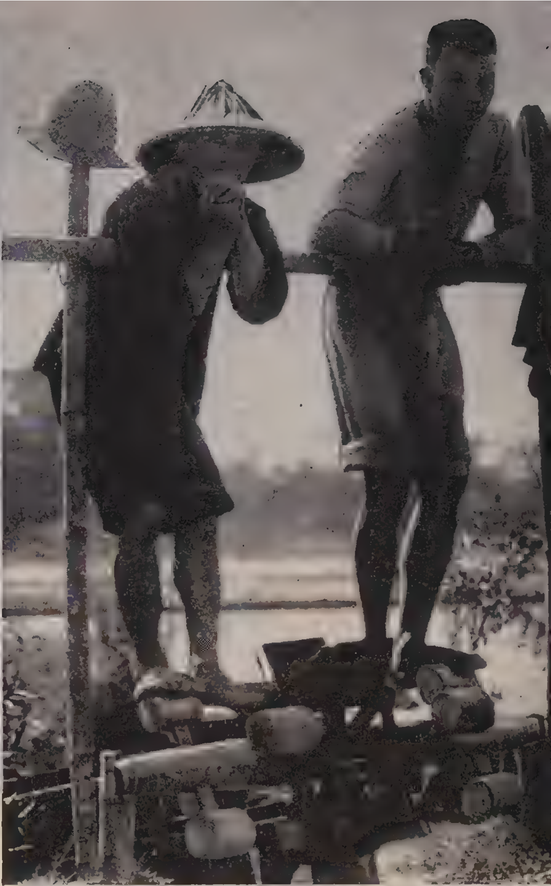
WATER PLANTS. See AQUATIC PLANTS.

WATER POLO, a ball game similar to hockey, played by swimmers, with a ball filled with air, which floats. It is a good game for swimming tanks, and is then played generally throughout the winter season. The object of the game, of course, is for one side to carry, push or throw the ball to the opponent's goal line, at the end of the tank.

WATER POWER. A waterfall capable of being "harnessed" to perform work has been appropriately referred to as "white coal." Much of the machinery of the world is operated directly or indirectly by water power. A great factory located where the power of falling water is available may be electrically operated, but water power may be utilized to generate the electric current. The installment of a water-power plant usually requires the construction of a dam, a canal or flume to conduct the water to the great paddle wheel, where the power of the water is applied. The original expense may be greater than that of a steam or electric plant, but the extra cost is soon recovered by the saving in operating expenses. See WATER WHEEL.

Classification. Water-power plants are divided into three classes—*low-head, medium-head,* and *high-head,* according to the height of the fall. Low-head plants have a fall not exceeding 100 feet; medium-head, not exceeding 350 feet, and the high-head class includes all plants having a fall of more than 350 feet. The fall of some plants in this class exceeds 5,000 feet. Most of the great plants are of low-head type, and they are located on the banks of large streams. They gain in volume what they lose in fall. The largest plants of this type are at the Wilson Dam in Alabama and one at Keokuk, Iowa. The most noted plant of the medium-head type is at Niagara Falls.

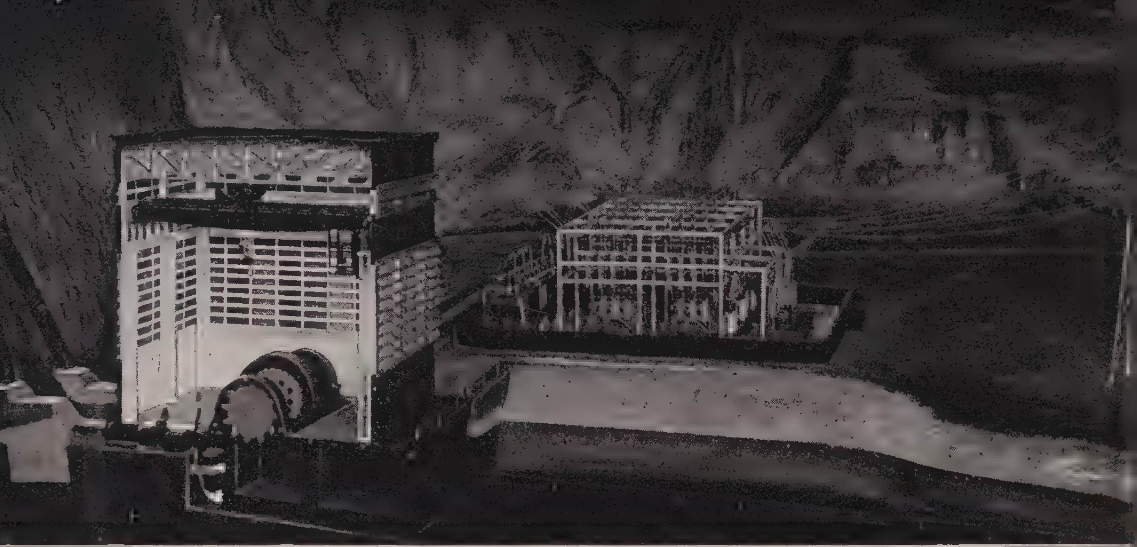




ANCIENT DEVICES

rly methods of raising water and of utilizing its ver are in use today. The Archimedean screw, inted 200 B. C., is still used in Egypt; the Oriental orts to foot-power; undershot and overshot terwheels generate power to operate machines.

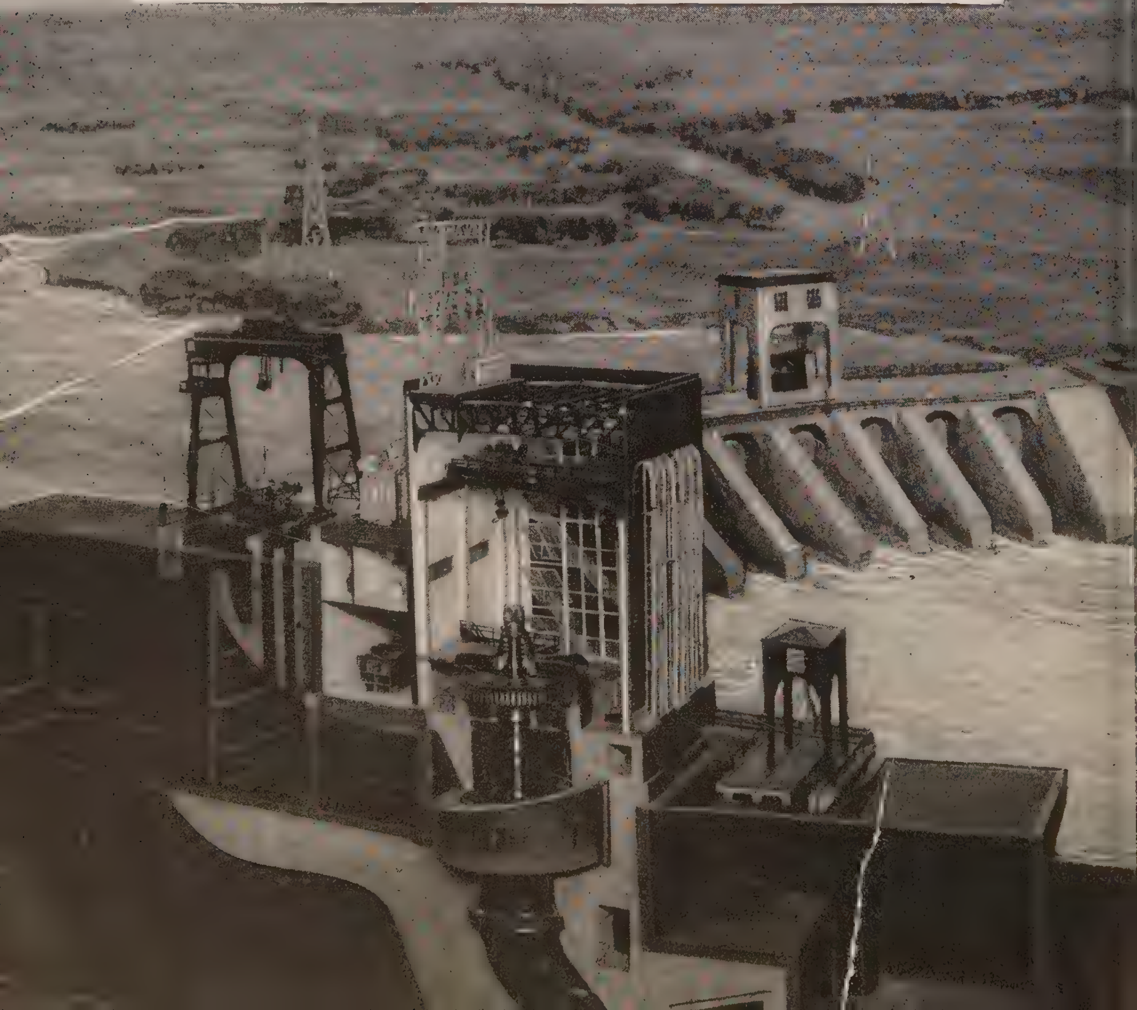
Kaufmann-Fabry



WATER POWER AS DEVELOPED TODAY

Raging torrents and broad streams are harnessed, and giant turbines generate electricity to turn the wheels of industry. A high-head power plant utilizes a fall of water from extreme heights, while dammed streams provide the power for low-head plants.

Century of Progress Electric Power Exhibit



Plants of the high-head type are usually found on mountain streams having a rapid flow and small volume of water. A dam is constructed across a deep, narrow valley to impound the water, which is conducted to the power house through steel pipes. The power house may be two or three miles below the dam, so a high fall is secured. These plants are operated by a small volume of water under very high pressure and they require a special type of water wheel (see TURBINE WHEEL). Their principal use is in generating electric power, which is often carried long distances over wires. The power used in operating the street cars in San Francisco, for instance, is generated over 125 miles from the city.

Estimating Water Power. The power of water for operating machinery is derived from its weight or pressure. The pressure of a column of water of a given height is equal to the weight of the water. A cubic foot of water weighs 62.5 pounds; therefore a column of water one foot square and ten feet high weighs 625 pounds, and at its base exerts a pressure on a square foot equal to that weight. The rule for estimating the horse power of a water fall is as follows: Multiply the flow in cubic feet per second by the height of the fall and this product by .1134. A fall of 100 feet and 600 cubic feet flow will have a power equal to 100X600X .1134, or 6,804 horse power.

Government Ownership. In the United States all water power on government land is under control of the government, and since the beginning of the present century stringent laws for preventing great power sites from falling into the hands of monopolists have been passed. Unfortunately, however, before the conservation movement was started, many valuable sites had been appropriated by capitalists and a legal claim to them had been established. Since water, like air, is one of the great natural resources of a country, the theory of the most enlightened governments is that it belongs to all the people; therefore all water power should be under control of the government, and it should be leased, not sold. Canada is far ahead of the United States in this respect, for in Canada all water power is under government control. Power sites may be leased, but none can be purchased.

It is estimated that the total water power of the United States is 30,000,000 horse power, and that less than one-sixth of it has been developed. The water power of Canada is estimated at 43,000,000 horse power, only about fifteen per cent of which has been developed. Europe has 41,000,000 horse power, and utilizes only one-tenth of it. The water power of the other continents is not known.

WATERPROOFING, a process of rendering cloth and other articles proof against water. In the preparation of mackintoshes a solution of rubber is spread on the goods, and the cloth is doubled, pressed and finished with the waterproof layer in the middle. Such goods are impervious both to air and to water, but from a sanitary point of view they are not desirable for constant wear. A new process has been introduced, which renders the fabrics proof against water, but does not obstruct ventilation. The materials are saturated with soap and then dipped in an alum solution. Still another process, by which the same result is obtained, consists of treating the fibers of the cloth, instead of the manufactured, woven fabric, with the solution. Paraffin is often used as a substitute for rubber in waterproofing leather, wood and various other substances. Paper is made waterproof by immersing it in a solution of shellac in borax, a treatment which causes it to resemble parchment paper.

WATER PURIFICATION. Pure water is essential to health, and often one of the most perplexing problems connected with water supply is that of securing pure water. Because of its solvent power, all water obtained from natural sources contains more or less impurities, some of which may be highly injurious. Among the mineral impurities held in solution are usually found lime, iron, compounds of sulphur and sometimes compounds of lead. Impurities present but not held in solution are clay, particles of soil, animal and vegetable matter and bacteria.

Lime and sulphur are not injurious to health; neither is iron, unless it occurs in excess. The presence of clay, sand and organic matter makes the water turbid, and the organic matter renders the water dangerous to health. All these substances should be removed by purification processes.

The processes employed for purifying water on a large scale include settling or sedimentation, filtering and chemical treatment. Settling is secured by allowing the water to remain quietly in large tanks, from which it flows slowly from the top. Where the water contains a large quantity of solid matter two or three settling tanks may be necessary, but usually one is sufficient. The sand and gravel of the earth form a natural filter for spring water, and this sort of filter is used in water purification. The filters consist of large tanks with perforated bottoms, over which layers of gravel and sand are placed. As the water percolates through these layers the solid matter and most of the bacteria are removed. If the water contains a large proportion of lime, it may be treated with a solution of sulphate of alumina. The lime separates this compound into alumina and sulphuric acid. The acid unites with the lime or magnesia in the water and renders it harmless, and the alumina coagulates and deposits the organic matter.

Home Tests. Epidemics of typhoid, diphtheria and other contagious diseases are often traced to impure water. Because water is clear, it does not follow that it is pure. A glass of the most sparkling water imaginable may contain millons of death-dealing germs, and every household should know of simple means of testing water whose purity is suspected. The following tests can be applied by any one at practically no expense:

(1) Into a vial containing about two ounces of water put a quantity of granulated sugar equal in volume to a pea or small bean. When the sugar is dissolved, cork the vial and set it in a warm place for forty-eight hours. If, when the cork is removed, the water emits a disagreeable odor, it is unsafe.

(2) Make a solution of permanganate of potash by dropping into an ounce of water a few crystals of this substance, which can be obtained at any drug store. Into a glass of the suspected water place a few drops of the solution. If the purple color disappears, the water is unsafe.

These tests are satisfactory within certain limits, but all water suspected of pollution should be tested by a chemist; any householder may have this done free of charge by sending a sample of the water to the State Department of Public Health. Water for household purposes should not be run through lead pipes, for it may attack the lead and form poisonous compounds. See LEAD POISONING.

Many cities impregnate their water with chlorine before it reaches the water mains.

WATERSHED, an elevation of land which separates the headwaters of natural drainage systems. Such a configuration of land is sometimes called a *divide*. A watershed separating great river systems may be only a slight rise of ground, such as the divide between the waters flowing into Hudson Bay on the north and the Gulf of Mexico or the Atlantic on the south and east. Again it may be a range of lofty mountains, such as the Rockies, which separate the headwaters of streams flowing respectively into the Mississippi and the Pacific.

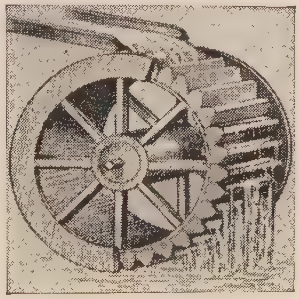
WATERSPOUT, a whirling column of water extending from a cloud to the surface of a body of water like the ocean or a lake. The presence of this column is marked by the cloud of vapor which it contains. This cloud is formed by the rapid condensation of the moisture in the atmosphere, due to expansion and rapid cooling caused by the low pressure in the area occupied by the column. If the conditions continue a sufficient length of time, rain is produced and sometimes falls in such quantities as to constitute a small deluge. In waterspouts over the ocean, the lower part of the column may contain vapor from salt water, but usually the vapor is that of fresh water. Waterspouts are caused in the same way as whirlwinds. See WHIRLWIND.

WATERTOWN, N. Y., the county seat of Jefferson County, seventy-three miles northeast of Syracuse, on the Black River and on the New York Central Railroad. The city is the center of one of the most productive dairying regions of the country. The river furnishes extensive water power, and there are large manufactories of paper-making machinery, air brakes, clothing, plumbing supplies, thermometers and paper specialties. The first American-made portable steam engine was manufactured in Watertown in 1847, and the first of the F. W. Woolworth chain of five-and-ten-cent stores was established here in 1878. Watertown is the commercial center for the Thousand Islands, Lake Ontario and western Adirondacks, and has an extensive summer tourist business because of its proximity to these resorts. Watertown was settled in 1800, was made the county seat in 1805 and was chartered as a city in 1869. It adopted the commission-manager form of government in 1920. Population, about 34,000.

WATERTOWN, S. D., the county seat of Codington County, 214 miles west of Minneapolis, on the Big Sioux River and on the Chicago & North Western, the Chicago, Rock Island & Pacific, the Great Northern and the Minneapolis & Saint Louis railroads. It has regular air service. Watertown is in the lake region of northeastern South Dakota. It is an important shipping point for grain and livestock and a leading marketing center for poultry and certified seed potatoes. There are large grain elevators, warehouses and flour mills, and manufactories of millwork, agricultural implements and foundry and machine-shop products. It was incorporated in 1885 and is governed by a mayor and council. Population, about 13,000.

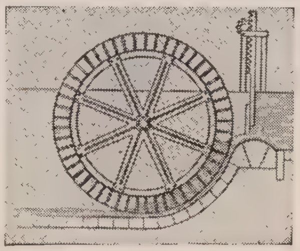
WATERVILLE, Maine, a city in Kennebec County, seventeen miles northeast of Augusta, on the Kennebec River and on four lines of the Maine Central Railroad. There is a modern municipal airport. The Belgrade Lakes resort country is ten miles west of Waterville. Railroad repair shops are here, and there are manufactories of cotton and woolen goods, pulp and paper products, men's shirts, canoes, traction engines and iron products. Colby College is here. Waterville was first settled about 1760, but it remained a part of Winslow until it became a town in 1802; it was incorporated as a city in 1883. Population, about 18,000.

WATERVLIET, *waw tur vleet',* N. Y., a city in Albany County, on the Hudson River, opposite Troy, near the terminals of the Erie and Champlain canals, and on the Delaware & Hudson railroad. A United States arsenal was established here in 1807 on a reservation of 109 acres, and has since been one of the largest permanent centers in the country for the manufacture of war materials. Other manufactures include steel, lumber products and precision instruments. Watervliet was first called West Troy. It was incorporated as a village in 1836 and as a city in 1897. The first Shaker settlement in America was here. Population, about 15,000.



OVERSHOT WHEEL

WATER WHEEL, a wheel constructed and set up for operating machinery by water power. The old style water wheels were large wooden structures, rotating upon a horizontal axis. They were constructed of two frames, from four to six feet apart, joined at their circumferences, with buckets or floats attached, as occasion required. They were known as *overshot or undershot* wheels, according to the method of operating, the overshot wheel receiving water at the top, and the undershot at the bottom. Each of these is described under its respective title. The *breast* wheel has the water admitted to the floats at a point horizontally opposite the axle.



BREAST WHEEL

A recent modification of the undershot wheel consists of a small iron wheel, with cups or buckets upon its circumference the whole enclosed in an iron box. This is often known as the *impact wheel* or, *water motor.* The water issues from a small nozzle under very high pressure, and as it strikes the box it causes the wheel to revolve with great rapidity. These wheels are convenient, because of their small size and the ease with which they can be placed in almost any desired position, but they are of use only in cities where the waterworks enable a high pressure to be obtained. Another form of wheel in common use is the turbine. See Turbine Wheel; Water Power.

WATERWORKS, the system of reservoirs, pumps and mains arranged for supplying a community with water for domestic use, manufacturing purposes, fire protection and street and lawn sprinkling. The water supply of large cities is usually conducted from near-by lakes or rivers; small towns obtain their supply from springs or wells. The selection of a source of supply must be made with great care, in order that it may be free from decaying animal and vegetable matter and other organic impurities. It must also be free from sewage contamination. Cool water is considered better than warm, because it is less hospitable to the propagation of life.

Where the source of supply is a long distance from the city, a reservoir is usually constructed, which is connected with the city by an aqueduct emptying into one or more smaller reservoirs, as in the New York City plant. From these reservoirs the water is distributed through mains to different portions of the city, and from the mains to consumers. When a city is situated near a suitable source of supply, the water is pumped directly through the mains, as is the case in Chicago, which secures its water from Lake Michigan. Small cities commonly use standpipes for reservoirs. These are constructed of iron or steel, and are mounted on foundations of masonry.

WATSON, JOHN (1850–1907), an English author and clergyman, best known by his pen name, IAN MACLAREN. He was born at Manningtree, in Essex, of Scotch parents. He graduated in 1870 at the University of Edinburgh, and studied theology at New College, Edinburgh, and at Tübingen. His first charge was at Logiealmond, in Perthshire. In 1877 he became associate pastor of Saint Matthew's Church, Glasgow, and he took charge of the Sefton Park Presbyterian Church, Liverpool, in 1880. A number of sketches of humble Scottish life, which were published in the *British Weekly,* were in 1894 collected into a little volume called *Beside the Bonnie Brier Bush.* This has remained the author's most popular work. Among his other writings are *The Days of Auld Lang Syne, Kate Carnegie* and *A Doctor of the Old School.* Under the name John Watson, he wrote *The Mind of the Master* and other religious works.

WATSON, JOHN BROADUS (1878–), an American psychologist, leader of a school of psychology known as *behaviorism.* This is a movement that opposes the belief that consciousness or insight is the key to human actions, and asserts that a person's behavior should be described in terms of his physical response to stimuli. Watson was born in Greenville, S. C. He received the degree of Ph. D. at the University of Chicago in 1903, and from 1908 to 1920 was director of the psychological laboratory and professor of experimental and comparative psychology at Johns Hopkins. He edited the *Psychological Review* and *Journal of Experimental Psychology* and wrote a number of books setting forth his theories. These works include *Animal Education, Behavior, Suggestions of Modern Science Concerning Education, Behaviorism, Ways of the Child* and *Psychological Care of Infant and Child.*

WATSON, WILLIAM (1858–1935), an English poet, author of *Purple East,* containing his best sonnets; *The Year of Shame,* an indictment of England's policy in the Orient; *The Hope of the World; Studies in Poetry and Criticism,* and other works.

WATT, in electricity, a unit of power named for James Watt. It is a measure of the rate at which energy is used or transformed and is equivalent to one joule per second, or about 44.2 foot-pounds per second (see FOOT-POUND; JOULE). The power used to operate an electric device can be calculated from voltmeter and ammeter readings in the circuit. In a direct-current circuit the power (in watts) is equal to the electrical pressure (in volts) times the current (in amperes); in an alternating-current circuit, watts = volts × amperes × a "power factor." If a 100-watt lamp burns for 4 hours, the household meter will show that 400 watt-hours of energy are used; that is, energy = power × time. See also ELECTRIC METER; KILOWATT; WORK.

WATT, JAMES (1736–1819), a Scottish engineer, celebrated for the improvements he made in the steam engine. He was born at Greenock, Scotland. Having determined to adopt the trade of making mathematical instruments, Watt went to London, at the age of eighteen, to learn the art; but ill health compelled him to return after only a year's apprenticeship. Shortly after his return he was appointed maker of mathematical instruments for the University of Glasgow. Resigning this position after a time, he worked as a civil engineer, making surveys for canals and harbors. In 1764, while repairing a Newcomen engine, Watt made experiments which resulted in the improvements that have made his name famous. In partnership with Matthew Boulton, a Birmingham manufacturer, he founded, at Soho, a factory where, in 1774, was completed the prototype, in principle, of the steam engine of today. See STEAM ENGINE.

Watt was a fellow of the Royal Societies of London and Edinburgh and a foreign member of the National Institute of France. Besides improving the steam engine, he invented or improved a variety of mechanical appliances, including a letter-copying press, a machine for reproducing sculpture and a fuel-saving furnace.

WATTEAU, *vah toh',* JEAN ANTOINE (1684–1721), one of the most celebrated painters of the eighteenth century, born of humble parents, in Flanders. At eighteen he went to Paris, where after years of struggle in obscurity he became a court favorite. In time his reputation extended throughout

Europe. His name is chiefly associated with a style characterized by ideal gardens and woodlands peopled with richly costumed men and women, who disport themselves with all the airs and formal graces of the times. In 1717 Watteau became a member of the Academy. He was a favorite of Frederick the Great, and today the finest collection of Watteaus in the world is owned by Germany.

WATTERSON, *wat' tur son,* HENRY (1840–1921), for nearly fifty years one of the most influential newspaper editors in the United States. He was born at Washington, D. C., was privately educated and at the age of twenty joined the staff of the Washington *Star.* He removed to Nashville in 1861, where he edited the *Republican Banner,* and during the Civil War he served in the Confederate army. The *Republican Banner* was revived after the close of the war; and in 1867 Watterson went to Louisville, where he founded the *Journal,* later consolidated with the *Courier,* and then known as the *Courier-Journal.* He steadily refused office, but in 1876 he accepted a seat in Congress, serving with distinction, but declining reelection. From 1872 to 1892 he was a delegate at large to every Democratic national convention, and he was until his retirement from active service in 1918 a power in national politics, through his editorials in the *Courier-Journal* and his strong personality. In 1919 he published *Looking Backward,* a series of sketches in which he reviewed in a personal vein his country's history for five decades.

WATTS, *wots,* GEORGE FREDERICK (1817–1904), an English artist, famous for his portraits, but chiefly for allegorical and symbolical pictures in which he attempted to show the power of love and the ugliness of greed. Watts was born in London, and at the age of thirty he married the actress Ellen Terry. The marriage was soon annulled. Among his more important pictures are *Love and Death,* now in Washington; *Life's Illusion, The Window Seat* and *Sir Galahad.* He is one of the most subtle and powerful of portrait painters, among his successful works in this line being portraits of Tennyson, Millais, Sir Frederick Leighton, Cardinal Manning and Browning.

More than almost any other artist, he devoted himself to the artistic interests of the nation, gratuitously decorating the dining hall of Lincoln's Inn and giving the best of his work to form the nucleus of the National Gallery of British Art. The principles of his art are best summed up in his own words, "The end of art must be the expression of some weighty principle of spiritual significance, the illustration of great truth."

WATTS, ISAAC (1674–1748), an English clergyman and writer, noted for his hymns. He was born at Southampton. After tutoring six years, he became minister of the Independent Church in Mark Lane, in 1702. A severe illness ended this engagement and Watts spent the remainder of his life with Sir Thomas Abney, at Theobalds. Among his works are *Divine and Moral Songs for Children, Hymns and Spiritual Songs, Psalms of David Imitated* and *Horae Lyricae,* the last three containing nearly five hundred hymns and versions. "When I survey the wonderous cross" is said to be Watts's finest hymn, and with Ken's *Morning Hymn,* Charles Wesley's "Hark, the Herald Angels" and Toplady's "Rock of Ages," it stands at the head of all hymns in English.

WAUKE'GAN, ILL., is situated on Lake Michigan thirty-five miles north of Chicago and fifty-five miles south of Milwaukee. Surrounded by rolling farms, the city is an agricultural, retail, and industrial center. Waukegan's fine harbor facilities, accommodating the largest lake vessels, and its location on four railroads have spurred its growth and prosperity. Over four hundred Waukegan products reach worldwide markets. Among them are asbestos supplies, building materials, automotive equipment, enamel and paint products, plastics, boilers, precision tools and dies, envelopes, marine motors, pharmaceuticals, wire and wire products, and leather goods. Sheridan Road, a boulevard linking Milwaukee and Chicago, passes through the city. Just north of Waukegan is the summer camp of Hull-House in Chicago. Thousands of vacationists enjoy the Illinois Beach State Park overlooking Lake Michigan. Not far from the city are fifty-six lakes and resorts. Great Lakes Naval Training Center, largest in the nation, is just south of Waukegan.

Waukegan was settled in 1835. It was called Little Fort until 1849, when it was incorporated as a town and renamed Waukegan, the Potawatomi word for *little fort.* The first settlers found the ruins of an old stockade, thought to be the site of a French trading post dating from 1700. Waukegan became the county seat of Lake County in 1841 and was chartered as a city in 1859. The population is about 46,275.

WAUKESHA, *waw'ke shaw,* Wis., the county seat of Waukesha County, seventeen miles west of Milwaukee, on the Fox River and on the Chicago, Milwaukee, Saint Paul & Pacific, the Chicago & North Western and the "Soo Line" railroads. There is an airport. It has numerous mineral springs, and its principal industry is the bottling and shipping of water. There are also structural steel works, steel-bridge and malleable-iron works, plow and motor works and canning factories. Carroll College and the state industrial school for boys are located here. Other features of interest are the Rest Haven sanitarium, the courthouse, a public library and three parks. The place was settled in 1836, and incorporated as a city in 1898. The population is about 21,000.

WAUSAU, *waw'saw,* Wis., the county seat of Marathon County, 180 miles northwest of Milwaukee, on the Wisconsin River and on the Chicago & North Western and the Chicago, Milwaukee, Saint Paul & Pacific railroads. It is surrounded by a lumbering, agricultural and dairying section, which also has extensive granite quarries. The river furnishes good water power, and the city maintains sawmills, sash and blind factories, machine shops, box and veneer factories, also paper and flour mills. A county training school for teachers, a county school of agriculture and domestic science, an asylum for the insane and a tuberculosis sanitarium are located here. The city also has a public library, a hospital, a fine courthouse and a city hall. The place was settled in 1842, and was at first known as Big Bull Falls. It was chartered as a city in 1872. Population, about 34,000.

WAVES, *wayvz,* disturbances in matter, which result in carrying force from point to point, often to a great distance. The most familiar *visible* waves are those produced by the wind on the surface of a body of water. *Invisible* waves are those minute vibrations produced within a body, by striking it or by some other means of agitation. These waves are manifest through their results, as in sound, heat and light.

When waves are produced by the disturbance of a small quantity of liquid, as by throwing a pebble into a pool, they appear to advance from the point where the pebble strikes, in widening, concentric circles, the height of the wave decreasing gradually as the circle enlarges. There is, however, no progressive motion of the liquid itself, as may be seen by watching a body floating on its surface. This is true of large, as well as small, waves, and the waves of the ocean, which sometimes reach a height of forty feet or more, do not cause the water to move forward. Breakers are caused by the friction of the water on the bottom of the sea, which retards the motion at the wave base and causes the crest to break over it. They never occur in deep water. See SOUND.

WAX, a solid, fatty substance derived from animal and vegetable sources. A by-product of petroleum, paraffin, is a similar product, having a number of uses. The chief kinds of animal wax are *beeswax* and *spermaceti.* The first is secreted by bees to build their cells. It is used in the arts for modeling, and in making ointments, plasters and candles. Spermaceti, a constituent of whale oil, is used for making toilet creams and candles. A wax secreted by the pores of sheep and extracted from the cut wool is used in dressing leather. Myrtle wax, palm wax and Japanese wax are of vegetable origin. From myrtle wax bayberry candles are made. Vegetable wax is the basis of the finest Japanese lacquers.

WAX MYRTLE, or **WAX TREE.** See CANDLE-BERRY.

WAXWING, a handsome singing bird, distinguished by its high, pointed crest, yellow band across the end of the tail and red spots on the wings, which have the appearance of sealing wax. The body plumage is reddish-brown above, yellowish underneath. The *cedar waxwing* is found in nearly every part of North America, and may be seen in summer as far north as Southern Alaska. It feeds on insects

WAXWING

and fruits, and nests in trees. The eggs are putty-colored, with black specks. The *Bohemian waxwing,* a familiar bird in both eastern and western hemispheres, also migrates to high latitudes in the nesting season, traveling, like the cedars, in small flocks.

WAY BILL. See Bill of Lading.

WAY'CROSS, Ga., the county seat of Ware County, ninety-seven miles southwest of Satilla River and on the Atlantic Coast Line, the Waycross & Southern, the Waycross & Western and the Atlanta & Birmingham railroads. It is the center of a fertile section, in which are gown cotton, fruit, live stock, pecans and sugar cane. There is abundant timber, and the city has large saw and planing mills. Other industrial establishments are railway shops, an overall factory, a packing plant, a turpentine plant, a cotton gin, a cold storage plant and a fireproof warehouse for cotton. There are a Federal building, a courthouse, a Y. M. C. A., Kings Daughters' Hospital and Baptist Institute. Waycross received a city charter in 1909. Population, about 19,000.

WAYNE, *wane,* Anthony (1745–1796), an American revolutionary leader, called "Mad Anthony" Wayne because of his brilliant bayonet charge on Stony Point in 1779, the most daring feat of the Revolutionary War. He was born at Easton, Pa., and was prominent in the patriotic movements before the Revolution. He served in the Pennsylvania legislature and in 1775, when the war broke out, he joined the army, was colonel of a volunteer regiment, and early in 1776 accompanied the expedition to Canada. For some time he was in command of a fort at Ticonderoga, and he afterward took part in the battles of Brandywine, Germantown and Monmouth. He captured Stony Point with a light infantry corps and became a popular idol; this was one of the romantic episodes of the war.

After the surrender of Cornwallis at Yorktown, at which he was present, he served for a time in Georgia and South Carolina. After the close of the war he held a number of civil offices in Pennsylvania and then removed to Georgia. In 1791 and 1792 he represented Georgia in Congress. In 1792 he was made general in chief of the United States army and was given command of an expedition against the Indians in the West. He defeated them at Fallen Timbers in August, 1794, and he concluded with them the Treaty of Greenville, by which the United States gained a large tract of land.

WEALTH, *welth,* a term used in economics to signify all material goods that have value. There are three essential qualities for objects classified as having value; they must be useful, must be limited in supply, and must be transferable. Gold, for example, comes under the category of wealth, for it has utility, it is produced in limited quantity, and it can be taken from one place to another. Health, while it is of priceless value to the possessor, is not wealth, for it is not a material thing. The possession of health is an aid to one who seeks to acquire wealth, but is not wealth itself, according to the terminology of economics. The same statement can be made of intelligence, physical strength, skill, education, and other intangible possessions that are in themselves of great value to man.

Circumstances alter the relative value of objects classified as wealth. On a desert island a shipwrecked sailor with a belt of money would consider food and drink of far greater value than his gold. If he were rescued and taken to a country where food was plentiful his money would be again classified as wealth. The four phases of wealth —production, exchange, distribution and consumption—are fundamental in the consideration of the economic structure of the world.

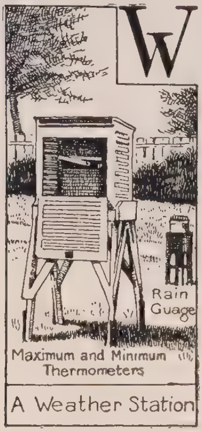
Related Articles. Consult the following titles for additional information:

Capital
Consumption
Credit
Economics
Money
Profit Sharing
Socialism
Supply and Demand
Wages

WEASEL, *we'zel,* a small, carnivorous animal, a native of almost all the temperate and cold parts of the northern hemisphere. The body is extremely slender, the head small and flattened, the neck long and the legs short. It preys upon mice, birds and other small animals and is very destructive to poultry. The weasel is usually nocturnal in its habits. It is a fine hunter, having a very keen scent and sharp sight, and, being unwearying in pursuit of its victim, it often wears to exhaustion animals larger than itself. Several species are common in the United States, and others are found in most parts of the temperate zones. The *long-tailed,* or *New York, weasel* is one of the most familiar species in North America. It is dark brown above and white beneath, and in winter in cold climates it turns pure white, except for the tip of the tail, which is black.

Related Articles. Consult the following titles for additional information:

Ermine	Polecat
Ferret	Sable



A Weather Station

WEATHER BUREAU, *weth'ur bu'ro,* a government bureau maintained by all civilized countries for the purpose of studying weather conditions and giving useful information thereon to the people. Mark Twain once said, "People have been talking about the weather for years, but nothing has ever been done about it." As a matter of fact, considerable has been done about it by the weather bureaus. Nobody can ward off a storm sure to be destructive to crops, but the approach of such a storm can be foretold and precautions may be taken to lessen its menace. Warnings of floods, frost predictions, advice on rainfall, recommendations as to irrigation needs—these and many other practical suggestions come from the weather bureaus and help to moderate the tyranny of the weather, which it must be confessed, is a force for good and for ill in the life of nearly every person. The United States Weather Bureau is typical of those of other countries, and in efficiency and in the practical service it renders it is one of the best in the world.

United States Weather Bureau. Previous to the Civil War several attempts to maintain a systematic weather service were made, but on the breaking out of that conflict all these were abandoned. The United States Weather Bureau was organized in 1870 as a division of the signal service in the War Department. The organization was under the supervision of General Albert J. Myer, chief signal officer of the army, and it was adopted by Congress as a national service. Under General Myer's management, *signal stations,* as they were then called, were established throughout the country. In 1891 the Weather Bureau of the signal service was made a bureau of the Department of Agriculture. In 1940 the bureau was transferred to the Department of Commerce.

The Weather Bureau is organized into a number of divisions, each of which carries on its special line of work. The most important of these are the following:

(1) **The Forecast Division,** which receives twice a day reports from stations in the United States, the West Indies, Europe, Asia, Alaska and Hawaii, and makes charts showing the conditions embodied in these reports. These charts are the regular weather maps of the bureau and include forecasts for the entire northern hemisphere. Their predictions are for twenty-four or forty-eight hours.

(2) **The Division of River and Flood Service,** which obtains information concerning the amount of rainfall, ice and snow in the basins of the principal rivers, whether navigable or not. The information which this division gives is for facilitating commerce and especially for protecting river valleys from floods, of which it aims to give ample warning.

(3) **Aviation Service.** Information which is provided especially for airplane pilots has been a most important factor in making travel by air comparatively safe. Local conditions are sent by radio to all fliers, but the Weather Bureau by frequent reports, day and night, keep pilots informed of conditions far ahead on lines of flight. Many of these reporters are also air-line employes.

(4) **The Division of Climate and Crops.** This division maintains a staff of voluntary observers, who give reports of the temperature, rainfall and other important data pertaining to the welfare and growth of crops in different parts of the country. This information is published in weekly and monthly crop bulletins, which are regarded as the highest authority on crop conditions of the country and are of the greatest benefit to agricultural interests.

(5) **Other Divisions.** These include divisions which have charge of examining and testing all instruments used, a division of records and divisions of telegraphy, radio, publications and supplies.

Observing Stations. There are over 200 regular meteorological stations in the United States. Each of these is in charge of trained observers and is equipped with a full set of instruments. These observations are taken at 7:45 A. M. and 7:45 P. M. Washington time, and the results are telegraphed to the central station of the district and to the office at Washington, from each of which maps are issued and reports transmitted to the country. These stations and numerous

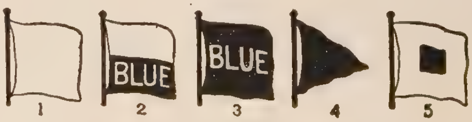
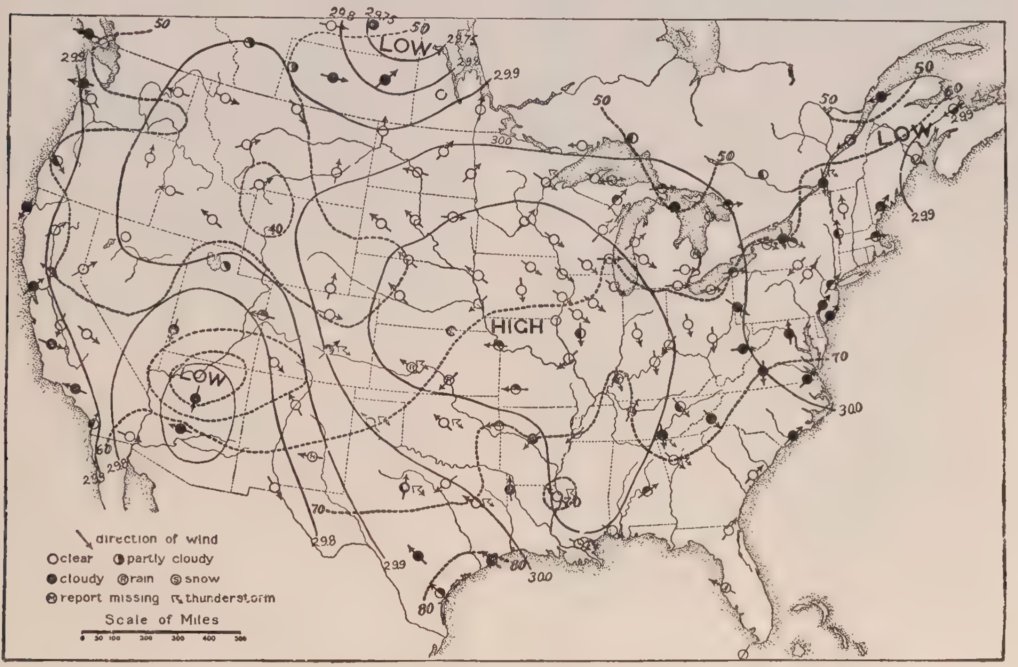


FIG. 1

other substations indicate the local weather conditions by the display of signals. A white flag (1 in Fig. 1) indicates fair weather. A flag with the upper half white and the lower half blue (2 in Fig. 1) indicates local rain or snow. A full blue flag (3 in Fig. 1) indicates general rain or snow. A triangular blue flag (4 in Fig. 1) indicates change of temperature. When placed below another flag it indicates colder, and when placed above, warmer. A white flag with a black square in the center (5 in Fig. 1) indicates a cold wave, which means a drop in temperature of from 15° to 20°.



UNITED STATES WEATHER MAP

The direction of winds is indicated by triangular flags, which are generally used in connection with storm warnings. The warning flag is red, with a black square in the center. When this is displayed with a triangular white flag above it, it indicates a storm with wind from the northwest. With the white flag below, it indicates a wind from the southwest (see Fig. 2). The warning flag with a dark triangle above indicates storm with wind from the northeast, and with the dark triangle below, storm with a wind from the southeast (see Fig. 3). The hurricane warning consits of two red flags with black centers, one above the other (see Fig. 4) Forecasts are also displayed in post offices and other public places, and in some sections of the country they are given by a series of signals by the whistles of locomotives.

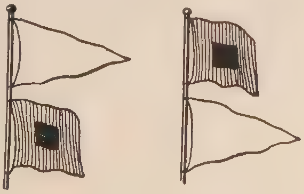


FIG. 2

Weather Charts. Through telegraphic reports received from all parts of the country twice each day the United States Weather Bureau constructs, twice daily, weather charts showing areas of high and low barometric pressure, the former generally indicating centers of storm disturbance; the general temperature of the different sections of the country, those of equal temperatures being connected by lines called isotherms

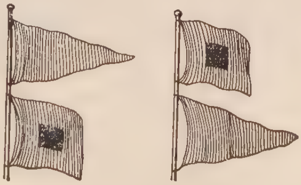


FIG. 3

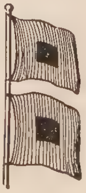


FIG. 4

the direction of winds and the condition of the atmosphere, the latter being denoted as cloudy, partly cloudy or clear, and including presence of rain, snow or thunderstorms. By comparing the map under construction with previous maps and with the latest reports from the various stations, the forecaster is able to tell in what directions the areas of low pressure are moving, and at what speed, and can thus predict, with reasonable certainty, changes of weather in all parts of the country. As to changes in temperature and the velocity and the direction of winds, information furnished by the bureau is almost never far wrong, but so many influences affect the condition of the atmosphere that it is more difficult to predict changes in this respect. The weather map shown here is an exact copy of one furnished by the government.

SOCIABLE WEAVER BIRD'S NEST

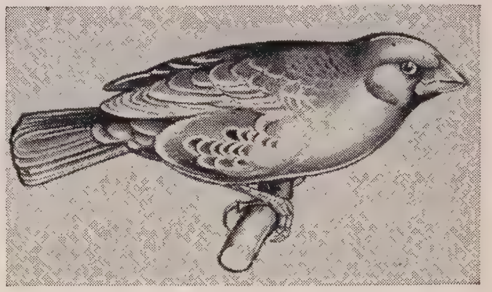
Canadian Bureau. In the Dominion of Canada the Meteorological Service, a division of the Department of Marine and Fisheries, performs the same tasks as the American Weather Bureau. The superintendent of the service has his headquarters at Toronto, Ont., and acts also as director of the Toronto Magnetic Observatory.

Related Articles. Consult the following titles for additional information:

Climate
Cyclone
Frost
Hail
Humidity
Hurricane
Isobars
Isothermal Lines
Meteorology
Rain
Rainbow
Snow
Storms
Tornado
Wind

WEAVER, *we'vur,* James Baird (1833–1912), an American political leader, born at Dayton, Ohio. He graduated from the law school of Ohio University in 1854, served in the Civil War and was brevetted brigadier-general at its close. He removed to Iowa, entered journalism, as editor of the Iowa *Tribune,* at Des Moines, and became a member of Congress in 1879 and again in 1885. In 1880 he was made the Greenback candidate for President of the United States and in 1892 was the candidate of the People's or Populist party, receiving twenty-two electoral votes.

WEAVER, *we' ver,* **BIRD,** a small bird resembling the finch, with pointed wings, a sharp, conical bill and unusually long claws. The name has reference to the bird's manner of building its nest, which is a wonderful structure of woven vegetable substances. The form and workmanship of the nests vary with the several species. The *yellow weaver,* or *baya,* of India, builds a long, bottlelike nest, and hangs it from a slender branch of tree or shrub, often over the water, where it is impossible for anything but a bird to enter. The *sociable weaver birds* build a large dome-shaped structure, or roof, in the forks of branches, and underneath this common roof many families build their nests, each with a separate entrance. While all members of the community work on the roof, each pair works alone on its own nest. See Baya.



WEAVER BIRD

BAYA'S NEST

WEAVING, *we'ving,* the art of making cloth by means of a loom, from threads or yarn. It is not known when weaving was first practiced, but it is certain that it is one of the earliest of the arts, and it seems probable that hand looms were invented independently by several of the ancient nations. The Greeks and Romans brought the weaving art to a high degree of perfection. Among modern countries Italy was the first to acquire fame for the manufacture of woolen and cotton cloths. France, England, Germany and the United States later developed extensive weaving industries. Since the fibers of wool are much more easily worked than those of cotton or flax, woolen cloth has always been made among the more primitive peoples before they attempted fabrics of linen or cotton.

In weaving, two sets of threads are necessary, one running lengthwise of the cloth, and called the *warp,* the other running crosswise, and called the *weft,* or *woof.* The threads of the warp are arranged on the loom by being wound on a yarn beam, at the back, and stretched evenly to the front, where they are fastened to another beam, upon which one cloth is to be wound. In passing from one beam to the other, the warp threads are laid through the *heckles* and also through a comb on the batten. In laying the warp, every other thread passes through one heckle, and the alternate thread passes through the other. The weft is wound upon bobbins, which are placed in the shuttle, by means of which the weft is laid in position. Weaving by hand loom includes the following steps: (1) pressing a treadle, which is connected with the heckles by a cord that passes over a pulley on the top of the loom. This spreads the threads of the weft, raising one-half and lowering the others, so that they form an angle called the *shed.* (2) Throwing the shuttle across the warp and thus laying the thread of the weft in position. (3) Striking this thread with the batten, so as to drive it close up against the one previously laid. (4) Springing down the opposite treadle and thus preparing the web for the next thread of the weft.

Weaving in these times is almost exclusively done by power looms, operated by steam or electricity. Simple as the hand loom is, it contains the elements of all modern looms. The complexity of the pattern may be increased by placing more than two frames in the heckle and dividing the weft into more parts, also by inventions which raise certain threads in the warp at one time and certain others at another. An invention known as the *Jacquard* loom operates upon this plan. Any number of cords can be used, so that a pattern of any degree of complexity is possible, and since all cords are tied together in the form of an endless chain, the pattern may be repeated indefinitely.

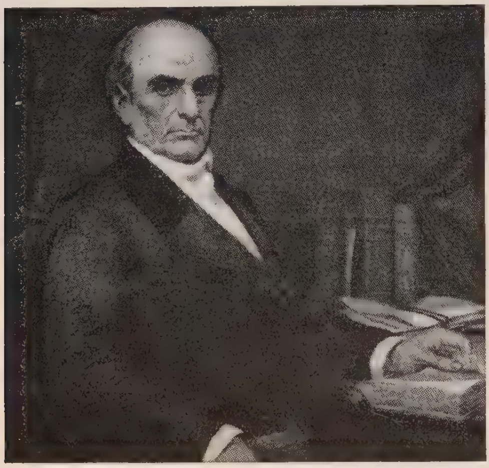
Mexican Government

WEAVING A CENTURIES-OLD DESIGN, a Mexican works at his family loom. The wool he uses was sheared from his own flock of sheep.

WEBB CITY, Mo., a city in Jasper County, five miles northeast of Joplin, on the Frisco and the Missouri Pacific railroads. It is the center of the zinc and lead mining district of Southwestern Missouri. Mining plants in the vicinity number about two hundred, and there are in addition machine shops, foundries, a cement block factory and a brick and tile plant. The city has a Federal building, a hospital and a public library. It was settled in 1873 and incorporated in 1876. Its population of about 7,000 has remained stationary for several decades.

WEB′ER, Karl Maria Friedrich Ernst von (1786-1826), a German composer, born at Eutin in Holstein. His father was a musician and gave him a good musical education. At the age of fourteen he wrote an opera, and in 1803 he visited Vienna, where he became acquainted with Haydn. He procured a musical directorship in Breslau, on which he entered in 1804, leaving it only to accept, successively, several more important positions. In 1820, at Berlin, he produced *Der Freischütz,* the most celebrated of his compositions. It was performed in London and Paris two years later. In 1822 *Euryanthe* was brought out, and in 1826 Weber visited London to superintend the production of *Oberon,* which he had composed for Covent Garden Theater. Shortly after its enthusiastic reception, the composer died in London. Besides the operas mentioned, Weber wrote a large number of works for the piano, notably the *Invitation to the Dance* and the *E flat major Polonaise.* He was the forerunner, in style, of Wagner, whom he strongly influenced. See WAGNER, WILHELM RICHARD.

WEBSTER, DANIEL (1782-1852), American orator and statesman, born in the township of Salisbury, N. H. His father was a backwoods farmer, who had previously been a hunter and soldier, and Daniel owed his first education to his mother. Later, in the intervals of farm work, he attended village school, and when he had reached the age of fifteen, his father made some generous sacrifices to send him to Dartmouth College, where he remained four years. After studying privately and in a Boston law office, he was admitted to the bar in 1805 and began the practice of law in Boscawen, N. H. Two years later he settled at Portsmouth, N. H., where he prospered.


U. S. National Museum

DANIEL WEBSTER

Webster at first took little interest in politics, but in 1812, having already established a commanding reputation, he was elected to Congress by the anti-war party. He was placed on the committee of foreign affairs, and his maiden speech, delivered on June 10, 1813, upon the Berlin and Milan decrees, took the House and country by surprise by its display of rhetorical power and wealth of historical knowledge. His subsequent speeches on the increase of the navy, which he warmly recommended, and the repeal of the embargo, placed him in the first rank of debaters.

In 1816 Webster retired for a time from political life, removing to Boston to devote himself to his profession. For nearly seven years afterward, with a single exception, he filled no public office, but as an advocate and counselor achieved a pre-eminent position at the American bar. His strongest powers were displayed in arguing points of constitutional law, and his achievements in this direction drew upon him the attention of the whole country. In 1820, on the celebration of the bicentenary of the landing of the Pilgrim Fathers, he delivered an oration which added greatly to his fame as an orator, and he continued to gain in public esteem through other great addresses, notably those at the laying of the cornerstone of Bunker Hill Monument in 1825 and at the memorial service for Adams and Jefferson in 1826.

In 1822 he was elected to Congress, and was re-elected in 1824 and 1826. At the end of his last term he was chosen Senator for Massachusetts. In January, 1830, he delivered a remarkable speech in favor of the nationalist view of the Constitution, in reply to a speech by Robert Y. Hayne of South Carolina. The address created a sensation throughout the Union and probably was more widely circulated throughout the country than any other in previous American history. Webster was strongly opposed to the nullification movement of Calhoun and the South Carolina school, and his eloquence in support of Jackson's energetic measures did much to prevent secession. In 1836 he was an unsuccessful candidate for the Presidency, and from 1841 to 1843 was Secretary of State under Harrison and Tyler. The chief event of this period was the negotiation of the famous Webster-Ashburton treaty with England, which was equally advantageous and honorable to both parties.

Webster generously supported Clay's candidacy for the Presidency in 1844; and was himself an unsuccessful aspirant for the Whig nomination in 1848. In 1845 he was re-elected to the Senate, and in the struggle over the admission of Texas and California he strongly favored the Northern, or antislavery, side. Afterward, however, when public excitement had reached a dangerous height, he supported a policy of compromise, and March 7, 1850, he made a speech in favor of obedience to the Fugitive Slave Law. The same year he was appointed a second time as Secretary of State, which office he held till his death.

Webster's guiding principle in politics was the preservation of the Union, for which he was ready to make all sacrifices, opposing the nullifiers, on the one hand, and the abolitionists, on the other. One of his best remembered utterances is that from the *Reply to Hayne,* ending with the exclamation, "Liberty and Union, now and forever, one and inseparable!"

Related Articles. Consult the following titles for additional information:

Calhoun, John C.
Clay, Henry
Nullification
Webster-Ashburton Treaty

WEBSTER, Noah (1758–1843), an American lexicographer, author of the original *Webster's Dictionary* and of *Webster's Spelling Book.* He was educated at Yale and prepared for the law, but gave it up for teaching. His experience in schools led to the composition of his *Spelling Book,* which was published in 1784, and of which it is said that 62,000,000 copies have been sold. About 1807 he began work upon his *American Dictionary of the English Language.* In preparing this work he visited England and worked for some months at Cambridge. The first edition of the dictionary was finished in 1828, and a second edition was published by Webster in 1840. This work was the basis of the standard *Webster's International Dictionary.*

WEBSTER-ASHBURTON TREATY, a treaty concluded at Washington in 1842 by Daniel Webster, then Secretary of State, and Lord Ashburton, minister of Great Britain to the United States. It defined the northeastern boundary between the United States and Canada, which for years had been a source of irritation between the two countries.

WEDGE, *wej,* one of the so-called mechanical powers used in the construction of machines, formed of a combination of two inclined planes. Wedges of wood or metal are used for splitting various substances or for exerting strong pressure in a small space. The axe, with its thin and its broad edge, is one application of the principle of the wedge. See Mechanical Powers.

WEDGWOOD, *wej'wood,* **WARE,** a superior kind of glazed pottery, capable of taking the most brilliant and delicate colors. It is usually decorated with classic designs, often in relief upon a solid ground. It is used not only for the table, but also for ornament; and, owing to its hardness and property of resisting the action of all corrosive substances, it is commonly used for mortars in laboratories. The ware was named after the inventor, Josiah Wedgwood. See Pottery.

Josiah Wedgwood (1730–1795), one of the greatest of English potters, was born at Burslem, of a family of successful potters. At the age of eleven he began making pottery on a wheel. The loss of a leg compelled him to give up this work, and he afterwards became head of his own pottery works and the most famous of English potters. Wedgwood made many improvements in the manufacture of earthenwares, and all subsequent work in this field has reflected his powerful influence.

WEDNESDAY, *wenz'day* (Woden's day), the fourth day of the week.

WEED, Thurlow (1797–1882), an American journalist, born at Cairo, N. Y. At the age of twelve he began to learn the printer's trade in Catskill, N. Y., and ten years later he was editing. He founded the Onondaga County *Republican,* and in 1824 became editor and owner of the Rochester *Telegraph.* He was elected to the legislature in 1826, and at the close of his second term he established the Albany *Evening Journal,* a Whig paper, which he edited for thirty-three years. During the Civil War, at the instance of President Lincoln, he was sent to Europe on a semi-official mission, and he did much to remove the misapprehensions as to the war, and to induce foreign governments to refrain from interference. In 1867 he became editor of the New York *Commercial Advertiser,* which position he resigned on account of failing health. He was the author of *Letters from Europe and the West Indies* and an *Autobiography.*

WEEDS, a term applied to plants that are out of place—not wanted, and in most cases very troublesome. Many plants when grown and cultivated in gardens, as the goldenrod and the dandelion, are classed as flowers, while the same plants, running wild in uncultivated ground, are considered as weeds. The chief ways in which weeds are injurious are: (1) They increase the labor necessary to cultivate the soil; (2) they take up food from the soil, which should go to useful plants; (3) their foliage smothers the young plants; (4) they sometimes are poisonous to cattle. Care should be taken to eradicate them as soon as they begin to grow. There are various ways to prevent their growth, different weeds requiring different methods. Planting of pure seed, diligent tillage of the soil, rotation of crops, cultivation of all open land with crops, are some of the means used. Some weeds while young can be destroyed without injury to the crop, by spraying the field with certain chemicals, called *herbicides*. Weeds are often of service to a farmer, in aiding him to know the needs of his land, since many kinds grow only where the conditions are peculiarly adapted to them. See HERBICIDES.

Related Articles. On page 517, in the article Botany, is a further discussion of the subject of weeds. For descriptions of the common weeds, consult the following titles:

Abutilon
Agrimony
Bindweed
Botany
Burdock
Canada Thistle
Cocklebur
Cow Parsnip
Dandelion
Dock
Feverfew
Fleabane
Goosefoot
Gromwell
Indian Mallow
Milkweed
Mullein
Pigweed
Plantain
Ragweed
Sand Bur
Sow Thistle
Stramonium
Thistle

WEEK, a period of seven days, one of the conventional divisions of time, the origin of which is doubtful. Among the ancient nations who adopted the week as a division of time, are the Chinese, the Hindus, the Egyptians, the Chaldeans, the Jews, the Persians and the Peruvians. In some cases the name has been applied to cycles of time other than that of seven days. The nations with whom the weekly cycle has been traced with certainty to the greatest antiquity are the Egyptians and the Hebrews. The use of the week was introduced into the Roman Empire from Egypt, about the first or second century of the Christian Era, and it had been recognized independently of Christianity before the Emperor Constantine confirmed it by enjoining the observance of the Christian Sabbath.

WEEVIL, *we′v′l,* the name applied to a group of very small beetles, most of which have long snouts, slightly curved downward. They are very destructive to the products of agriculture, some of them injuring the plants, others ruining the fruit or seed. With the long snout the insects of some species bore into nuts, grain or fruit and eat out the interior. Sometimes they deposit their eggs in the fruit, or seeds, so that the larvae will have food when hatched. In this way weevils often hatch out in meal, flour, rice and such food stuffs, spoiling them.

The *boll weevil,* which attacks the cotton boll, is one of the worst pests in the United States, having caused enormous losses to Southern farmers. It is a grayish weevil one-fourth of an inch long. It lies torpid in winter, and when the cotton comes up feeds on the leaves and blossoms. The eggs are deposited in the cotton boll, which the maggots destroy. There are four or more generations each summer. The *alfalfa weevil* is another species of considerable economic importance, and the United States Department of Agriculture has employed stringent measures to have it checked. Peas and beans are among other crops subject to weevil attack. The insects breed in the growing pod and also in stored beans and peas. When infested, the beans float in water and should not be planted. See BOLL WEEVIL.

WEIGHING, *way′ing,* **SCALE,** a mechanical contrivance for ascertaining the weights of substances. The simplest form of the weighing machine is the balance formerly used by grocers. It consists of a horizontal beam pivoted in the middle and having at one end a deep pan, in which was placed the article to be weighed, and at the other a horizontal disk. Pieces of iron of graduated size and ranging in weight from an ounce or less to several pounds were used on the disk to balance the article to be weighed. A modification of this scale is the unequal beam balance; based on the principle of the lever. The horizontal beam is not pivoted at the middle point, but near one end; the weight to be determined is placed upon the shorter end and is balanced by a much smaller weight at the long end.

The *platform scale* is a typical example. It consists of a hinged platform, set above a stationary platform, which sinks under a weight and presses upon a lever underneath. The lever is connected with a vertical rod attached to the short end of the horizontally-pivoted beam already described. The longer end, or lever, of the beam is marked off in a graduated scale. The article to be weighed is placed on the platform, which sinks under the weight, pressing upon the lever, which conveys the pull to the vertical rod connected with the beam. The weight on the long end of the beam is moved along the scale until it balances with the weight on the platform. The weight of the article on the platform is indicated by the mark in pounds at which the weight balances. A weight of one pound on the lever may be made to balance with ten, a hundred or even a thousand pounds or more on the platform. Some of these scales are even built to weigh heavy guns and locomotives.

Among the most recent inventions of scales is a complicated device which not only weighs the goods but also computes the price of fractions of a pound.

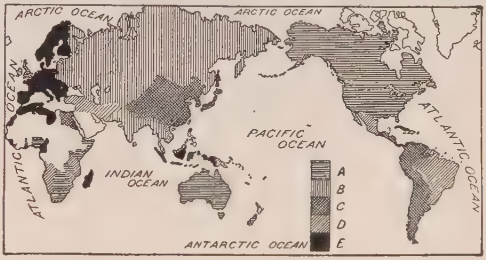
WEIGHT, *wayt,* the measure of the force by which any body or a given portion of any substance gravitates or is attracted to the earth; in a more popular sense, the quantity of matter in a body, as estimated by the balance, or expressed numerically with reference to some standard unit. In determining weight in cases where very great precision is desired, due account must be taken of temperature, elevation and latitude. Hence, in fixing exact standards of weights, a particular temperature and pressure of air must be specified; thus the standard brass pound of Great Britain is directed to be used when the Fahrenheit thermometer stands at 62° and the barometer at thirty inches. See, also, Gravitation; Weights and Measures; Metric System.

WEIGHTS AND MEASURES, the standards used in measuring quantities. Most of the common standard units have been chosen arbitrarily, though efforts have always been made to have the units conform to some natural rule. Evidences of this fact remain in the names of both ancient and modern units, such as the *cubit* of the Egyptians and Hebrews, which was the length of the forearm, and the *foot* of the Greeks, which was the length of a man's foot.

The so-called *English* system of weights and measures, used in the British Empire and the United States, dates from a law passed in 1266 in England, which provided that an English penny should equal in weight 32 wheat corns, taken from the middle of the ear; that 20 pence should make an ounce, 12 ounces a pound, 8 pounds a gallon of wine and 8 gallons of wine a London bushel. Before this time, two pound units had grown up; one, the *Troy* pound, introduced into England by William the Conqueror, weighed considerably less than that before used in England, and its introduction created such dissatisfaction that an average pound of sixteen ounces, now known as the *avoirdupois* pound, was made the standard unit for articles in common trade, while the Troy pound, of twelve ounces, was retained as the unit of weight for gold, silver, gems and apothecaries' supplies.

The units of length, capacity, weight and volume have often varied and are not yet entirely uniform, but the common standards of the English system are as follows: Of length, the *yard,* consisting of 3 *feet,* each foot containing 12 *inches;* 5½ yards equal 1 *rod;* 320 rods equal 1 *mile.* In England, the rod is called a *pole,* or a *perch.* The units of square and cubic measure are respectively the squares and cubes of the linear units, as *square yard, cubic inch,* etc. The *acre,* used in the measurement of land, contains 160 square rods. A *square mile* equals 640 acres.

There are two sets of measures of capacity, one for liquids and one for solids. The unit for liquid measure is the *gallon* of 231 cubic inches. The quart, one-fourth of a gallon, contains 57.75 cubic inches. The quart is divided into two pints and the pint into four gills. Standard gallon measures are maintained in England, Canada and the United States. The quart in dry measure contains 67.2 cubic inches; eight quarts make one peck and four pecks one bushel. The standard bushel contains 2130.42 cubic inches. The metric system (which see) is used in Europe.



THE WORLD'S WEIGHTS AND MEASURES
Showing the commanding position of the English system
(A) English weights and measures established and fundamental.
(B) English basis for linear measurements.
(C) Local and English prevail, and are closely identical. Metric also used.
(D) Metric, local and English.
(E) Metric prevails, with mixture of old and English.

There are numerous terms in use in special occupations, such as the *hand,* a unit used in measuring the height of an animal, and equivalent to about 4 inches; the *fathom* (2 yards), used in measuring the depth of water; the *knot,* or *geographical mile*

(6088.27 feet), used to designate distance at sea; the *chain* (4 rods), used in surveying; the *furlong* (10 chains); a *link* (.01 of a chain); the *ell* (3¾ feet); the *barrel* (31½ gallons); the *hogshead* (2 barrels). In England the barrel equals 36 gallons.

Making and keeping standards of the different units, weights and measures is in the hands of the governments of the respective nations. The work requires the greatest skill and care. In the United States these standards are prepared and kept by the United States National Bureau of Standards. In 1856 the British government sent to the United States two standards of length, which are still preserved. The same year the Treasury Department sent a complete set of weights and measures to the governor of each state. These sets are kept at the capitals of the respective states, and may be used for testing weights or measures whose accuracy is in doubt. Most states appoint inspectors whose duty it is to see that tradesmen do not use false weights and measures.

Related Articles. Consult the following titles for additional information:

Acre
Apothecaries' Weight
Avoirdupois
Barrel
Bushel
Carat
Centimeter
Cubic Measure
Drachma
Fathom
Foot
Furlong
Gallon
Gram
Hogshead
Kilogram
Kilogrammeter
Kilometer
Kilowatt
Knot
League
Liter
Mensuration
Meter
Mile
Ohm
Ounce
Pound
Quart
Scruple
Surveying
Ton
Troy Weight
Volt
Watt
Weighing Scale

WEIMAR, *vi'mahr*, GERMANY, an old city on the River Ilm, about fifty miles west-southwest of Leipzig, in the former grand duchy of Saxe-Weimar. The place is associated in a peculiarly interesting way with the new and with the old Germany. Here, in February, 1919, the first national assembly of the German republic (called also the Weimar Republic) met to establish a government based on democracy; here, in July of the same year, the Treaty of Versailles was ratified.

Weimar is famous, too, for its association with the classical epoch of German literature, and it has been called the "German Athens." Goethe, Schiller, Wieland and Herder lived here, and Goethe and Schiller are buried in the cemetery in the southern part of the town. Goethe's house is now the Goethe National Museum, and Schiller's house is also the property of the city and is open to the public. The Goethe-Schiller monument in bronze is in front of the famous court theater, in which the national assembly held its memorable sessions. Another striking building is the grand ducal palace, which was partially constructed under the supervision of Goethe. Stoves, straw hats, leather and cloth are the normal manufactures. Population, about 49,000. See GERMANY.

WELD'ING, the process of uniting two pieces of a substance when softened by heat. In the arts the term is restricted to splicing such metals as iron and platinum, though glass and several other substances can be welded as readily as these metals. The simplest method of welding iron is that employed in the ordinary blacksmith shop. The smith hammers the ends of the bars to be welded into a wedgelike form, and heats them white hot; and just as they begin to soften, he covers them with borax or some other flux, to prevent the formation of oxide. The hot ends are then laid together and hammered, the soft surfaces unite, and the joint formed is usually as strong as any other portion of the bar. In most manufactories, electricity is now very generally used for welding, a current of sufficient power to heat and soften the metals being employed. An acetylene torch is also used. See ACETYLENE.

WELFARE ISLAND, part of Manhattan Borough in New York City, is a narrow island in the East River. It is between Manhattan Island and Long Island and measures about one and one half miles long and one eighth of a mile wide. New York City purchased the island from Mrs. Robert Blackwell in 1828. It was called Blackwells Island until 1921, when it was renamed Welfare Island. There are many hospitals and medical centers on the island, including the Metropolitan Hospital, the New York City Hospital, the Cancer Institute, and the Central Neurological Hospital. The New York City Home for Dependents is also located here. A penal institution on Welfare Island was abandoned in 1935.

WELLAND, ONT., a city in Canada, is situated on the Welland Canal and the Welland River, about twenty miles west of Buffalo, N. Y. It is a railroad center and a port for freighters going through the canal. Welland produces iron and steel products, rubber, and shoes. Fruits from the surrounding regions are marketed in the city. The population is about 15,000.

WELLAND CANAL. The Welland Canal is a waterway on the Canadian side of the Niagara River, connecting Lake Erie and Lake Ontario. It was built so that ships could bypass Niagara Falls, and it is an important link in the St. Lawrence Seaway (see SAINT LAWRENCE WATERWAY and map). The first canal was opened in 1829. Ships going from one lake to another had to pass through twenty-five locks to overcome the 325-foot difference in water level. It took about sixteen hours to make the passage. Although this canal was improved, the growth of commercial transportation on the Great Lakes and the increased size of ships taxed the capacity of this, the only canal connection between the upper lakes and the ocean. In 1913, engineers submitted a plan for a new and larger canal which would utilize in part the waterway of the old. World War I delayed the completion of the new Welland Ship Canal, and it was not until 1931 that the first ships were allowed entrance. The canal runs from Port Colborne on Lake Erie to Port Weller on Lake Ontario, a distance of twenty-five miles. It is straighter and shorter than the old waterway. The canal is 310 feet wide at the waterline and 200 feet wide at the bottom. There are seven locks, each having a lift of about 46 feet. The locks are 820 feet long, 80 feet wide, and 30 feet deep. An eighth lock called a guard lock, controls the amount of water in the system. It is 1,380 feet long. Several of the locks are double. Huge 500-ton lock gates are electrically operated. Ships can go through the Welland Canal in about eight hours, and it has the capacity to handle at least 50 million tons of shipping yearly.

WELL DRILLING is the process by which wells are sunk to obtain petroleum, natural gas, water, or other fluids from under the ground. Most wells are drilled from a tall framework tower of steel called a *derrick*. The *cable-tool* system of drilling uses a heavy string of tools to which a cutting tool, or bit, may be attached. By means of a cable running through a pulley at the top of the derrick, an engine alternately raises and drops the string of tools so that the bit pounds its way through the earth. Now and then, water is poured into the hole and the debris is mixed into "slurry." The tools are then withdrawn, and the slurry is bailed out. Cable-tool drilling is now used chiefly for shallow wells.

Most wells are drilled by the *rotary* system. The bit is attached to a length of drill pipe, which is connected to a square or six-sided pipe called a *kelly*. The kelly is gripped in the middle of a steel turntable called a *rotary table*. When an engine turns the rotary table, the bit grinds into the ground. As the hole grows deeper, additional lengths of drill pipe are placed between the kelly and the pipe below. Sometimes there are more than three miles of pipe between the kelly and the bit. When the bit grows dull, all the pipe must be hauled out by the hoisting gear attached to the top of the derrick so that it may be replaced. Changing bits sometimes takes more time than drilling wells. The upper part of the well is lined with steel casing. This keeps the sides from caving in and prevents water from entering the hole. Mud is pumped down the drill pipe. As it rises between the pipe and the sides of the hole, it brings up the cuttings. It also cools the bit, seals the sides of the hole, and serves as a bearing for the drill pipe.

By means of special equipment, wells may be drilled at various angles. Thus several wells may be drilled from one place, or wells may be sunk under the sea from derricks erected on shore. Underwater drilling may also be done from barges. See ARTESIAN WELL; PETROLEUM; SALT.

WELLES, *welz,* GIDEON (1802–1878), an American statesman, born at Glastonbury, Conn. He attended Norwich University, and on leaving there became editor of the Hartford *Times*. He was a member of the state legislature from 1827 to 1835, in the latter year becoming state comptroller. From 1846 to 1849 he was chief of the bureau of supplies of the United States Navy. He joined the Republican party soon after its organization, and in 1861 was made Secretary of the Navy by President Lincoln. In this post he displayed remarkable executive ability, managing the navy with skill and efficiency during the war. He also served throughout Johnson's administration. In 1872 he supported the Liberal Republican movement, and in 1876 he worked for Samuel J. Tilden, Democratic nominee for President.

WELLESLEY, *welz'ly,* RICHARD COLLEY WELLESLEY, Marquis (1760–1842), a British general and statesman, brother of the Duke of Wellington. He was educated at Harrow, Eton, and Oxford and in 1784 entered the English House of Commons. In 1797 he was made governor-general of India, and for his suppression of the insurrection of Tippu Sahib of Mysore, and for the capture of Seringapatam, he was made Marquis Wellesley in the Irish peerage. He was also successful in the struggle with the Mahrattas in 1803–1805. His administration in India, which ended in 1805, was one of the most important in the history of British rule there, owing to his financial reforms and his military victories. In 1808, Wellesley was made minister to Spain, and in the following year he became secretary of state for foreign affairs. He was chosen prime minister in 1812, but was unsuccessful in his attempts to form a cabinet. From 1821 to 1828 and from 1830 to 1834 he was lord lieutenant of Ireland.

WELLESLEY COLLEGE, a nonsectarian institution for the higher education of women, founded in 1870 at Wellesley, Mass., twelve miles west of Boston. Until 1873, it was called Wellesley Female Seminary. The courses are largely elective, and lead to the degrees of Bachelor of Arts, Master of Arts, Master of Arts in Education and Master of Hygiene and Physical Education. The faculty includes about 200 instructors; the enrollment is about 1,500, and the library contains about 200,000 volumes. The endowment exceeds $9,000,000.

Henry Fowle Durant (1822–1881), the founder of Wellesley College, was born at Hanover, N. H., and educated at Harvard. After completing a law course he engaged in practice in Boston. Subsequently he became a lay preacher. Durant was officially treasurer of Wellesley College after founding the institution in 1870.

WELLINGTON, ARTHUR WELLESLEY, Duke of (1769–1852), a British general and statesman, the hero of the Battle of Waterloo. He was the son of the Earl of Mornington, and was educated at Eton, at Brighton and finally at the Military College of Angers, in France. In 1787 he received a commission as ensign in the army, and after a rapid series of changes and promotions he attained, by 1796, the rank of colonel. During 1794 and 1795 he served with his regiment under the Duke of York in Flanders, and in 1797 his regiment was dispatched to Bengal. War had just been declared against Tippu Sahib, and Colonel Wellesley's regiment had an important part in the Battle of Malavelly and the storming of Seringapatam. He was then appointed civil and military governor of Mysore, which was invaded in 1800 by the robber chieftain, Dhundiah Waugh, with an army of 40,000. Wellesley attacked with vigor and pursued him into Mahratta territory, where he was forced to surrender. In 1803 Wellesley took command of the British forces in the war against the Mahrattas and secured their submission, drawing up his own terms of peace. In his contacts with the native chiefs, he displayed a remarkable understanding of Oriental psychology. For his service in restoring British control in the territory he received the thanks of Parliament and was made Knight Commander of the Bath. In 1805 he returned to England, was shortly afterward elected to Parliament for Rye, and in 1807 was appointed secretary of state for Ireland. In August, 1807, he received the command of a division in the expedition to Copenhagen, and he directed the only land operation of importance. In 1808 he attained the rank of lieutenant-general and received the command of a force destined to operate in the north of Spain and Portugal. He was subsequently superseded; but before giving up the command he gained the Battle of Vimeiro over Junot, the campaign being brought to a close with the Convention of Cintra, by which the French agreed to evacuate Portugal. In 1809 Wellesley was appointed to take the chief command in the peninsula, which had been overrun by the French. The passage of the Douro, and the defeat of Soult, which followed, fittingly opened this masterly campaign. For the victory at Talavera (July 28), the first of many which he won in the peninsula, the government raised Wellesley to the peerage, as Viscount Wellington.

Toward the end of 1810 he fought the Battle of Busaco, which was followed by the famous fortification and defense of the lines of Torres Vedras. Before these fortifications the French encamped for months, but they were finally compelled, by lack of supplies, to evacuate Portugal. A little later (in 1811) occurred the victory of Fuentes de Onoro. Early in 1812 Wellington took Ciudad Rodrigo and Badajoz by storm, fought the Battle of Salamanca, accounted one of his most famous victories, and in August entered Madrid. For his brilliant conduct of the campaign, he received the thanks of Parliament and was raised to the dignity of marquis. Next followed the Battle of Vittoria (1813), battles in the Pyrenees, the capture of San Sebastian and the forced retreat of Soult.

In 1814 a victory over Soult was gained, and in the same year the Battle of Toulouse, in which Soult's best troops were routed, opened the way for the British troops to the heart of France. Napoleon abdicated on April 12, and a few days later the war was brought to a close by the signing of conventions with Soult and Berthier. The triumphant general was created Marquis of Douro and Duke of Wellington and was given the thanks of both houses of Parliament. In July he went as ambassador to France and succeeded Lord Castlereagh as British representative in the Congress of Vienna, and when Napoleon returned, Wellington took command of the army assembled in the Netherlands to oppose him, winning the great victory of Waterloo. On his return to England, after the restoration of peace, he accepted the post of master-general of the ordnance, with a seat in the cabinet of Lord Liverpool. In 1822 he represented Great Britain in the Congress of Verona, and six years later he accepted the premiership, resigning the command of the forces to Lord Hill. The growing discontent throughout the country on the subject of Parliamentary reform, which Wellington steadily opposed, caused the resignation of the government in 1830. He held office under Sir Robert Peel as secretary of state, and in 1846 he helped to carry the repeal of the corn laws, which till then he had opposed. He died September 14, 1852, and was buried in Saint Paul's Cathedral. See WATERLOO, BATTLE OF.

WELLINGTON, NEW ZEALAND, the capital of the dominion of New Zealand, a seaport situated on Port Nicholson, on North Island, 1,280 miles southeast of Sydney, the nearest Australian port. It has a fine harbor and an extensive export and import trade. Manufacturing establishments include flour mills, saw mills, tanneries, foundries, soap and candle works, brick kilns, etc. Important buildings are a government building, a museum, buildings of Victoria University College, and a branch of the New Zealand Institute. Population, about 173,500.

WELLS, HERBERT GEORGE (1866–1946), one of the most forceful and original of the modern group of English novelists. He was born at Bromley, Kent, of middle-class parents, and was educated at London University. After teaching for several years he began writing for magazines, and in 1895 produced a fantastic romance called *The Time Machine,* which met with instantaneous success. Other stories of a like character followed, including *The War of the Worlds, When the Sleeper Wakes* and *In the Days of the Comet.* In another series of novels of everyday life he found opportunities to set forth his belief in Socialism, as in *The Research Magnificent* and *The Passionate Friends. Tono Bungay* is much admired for its excellent character drawing, and *The History of Mr. Polly* for its naïve humor. In *Mr. Britling Sees It Through* Wells produced one of the outstanding books based on World War I. In 1921 appeared *Russia in the Shadows* and *The Outline of History,* followed by *The Science of Life* and other volumes. His last book was *Mind at the End of Its Tether* (1944).

WELSBACH, *vels'bahk,* KARL AUER, Baron von (1858–1929) an Austrian chemist, the discoverer of the rare elements praeseodymium and neodymium in 1885 and of lutecium in 1907. He is best known for his invention in 1885 of the Welsbach burner, an incandescent gas burner composed of a cone-shaped cotton-gauze mantle of oxides of thorium and cerium. By means of this burner, a strong, steady light is obtained with the use of a minimum amount of gas. It is used wherever gas is used for illumination.

Welsbach was born in Vienna and attended the university there; he also studied under Bunsen at Heidelburg.

WELWITSCHIA, *wel wich'e a,* a remarkable plant, growing in the dry regions of southern Africa. It consists of a stem, which forms a woody mass, rising not more than a foot above the ground and having a diameter of from four inches to as many feet. From this mass grow two enormous leaves, which become dry and are often split up into shreds, but which do not fall off. Every year several short flower stalks grow up from the base of these leaves, but no other leaves are ever produced.

WENTWORTH, *went'wurth,* THOMAS, Earl of Strafford. See STRAFFORD, THOMAS WENTWORTH, Earl of.

WESLEY, *wes'li,* the family name of two brothers famous as the founders of the religious sect from which the Methodist Church developed. John Wesley, the elder, was the leader of the movement.

John Wesley (1703–1791) was born at Epworth, England, June 17, 1703, a son of the village rector. His mother was a woman of intelligence and piety. The boy attended the Charter-House School and later Christ Church, Oxford, from which he was graduated in 1724. A year after his graduation he was ordained to the ministry, and for a time acted as his father's curate. When in 1729 he returned to Oxford he became associated with his brother Charles and a few other undergraduates in what was derisively called the "Holy Club."

In 1735 he and his brother Charles went with General Oglethorpe to America and for three years the brothers did missionary work among the Indians. John Wesley's preaching was not particularly successful, but the trip marked the turning point in his life, for on the journey over he made the acquaintance of some Moravian Brethren whose simple piety made a deep impression on him. On returning to London he sought the Brethren, and from Peter Böhler, one of their preachers, learned the doctrine of "saving faith." In the summer of 1738 he visited the Moravian leaders on the continent, and this experience confirmed him in his new faith in the saving power of Christ. Returning to England he became associated with George Whitefield, and his real life work as an evangelistic preacher began.

His new methods aroused much opposition, and churches were closed to him. He then began preaching in the open air, gaining a large number of followers. In 1740 an important step was taken when Wesley organized his first society and appointed lay preachers, who were communicants of the Church of England, to take charge of small groups of converts. The small meetings thus provided for caused the movement to spread rapidly. In 1744 the first conference of lay preachers was held. These remained members of the Established Church; it was not until 1784 that Wesley's organization became a new denomination, separate from the Church of England. Wesley was a prodigious worker, traveling long distances and preaching three or four times a day. At the same time he produced a large volume of religious literature. In 1750 he was married to Mrs. Vazeille, a widow with four children, but incompatibility soon led to a separation. At the time of his death Wesley's followers numbered 120,000.

A man of much charm of personality, kindly wit and humor, Wesley was admired even by those who opposed his doctrines. He retained his sprightliness and interest in all about him to the last. See METHODISTS.

Charles Wesley (1707–1788), a noted English evangelist, brother of John Wesley, aided his brother in founding the Methodist Church. He was born in Epworth, England, and was educated at Westminster School and at Christ Church, Oxford. In 1735 he went with his brother John to America and preached in the Georgia colony. His preaching was not successful, owing to his extreme views; and in 1738, influenced by his brother, he modified his doctrines and methods and became an itinerant preacher. He then began to attract large audiences. His chief service to the Methodist movement, however, was as a writer of hymns. He produced about 6,000, some of which remain favorites in the denomination.

WESLEYAN METHODISTS, an offshoot of the original Methodist Church, which preserved the form of church government originated by John Wesley. It is chiefly represented in the British Isles. The other important branch of the denomination, distributed chiefly in America, early adopted the Episcopal form of church organization and became known as the Methodist Episcopal Church. The Wesleyan Methodists joined the United Methodist Church (which see) in 1932.

WEST, BENJAMIN (1738–1820), an American painter, who made his way up from humble beginnings to a place of highest distinction in the world of his day. Painting and drawing he taught himself, making his colors of leaves and berries and his brushes of hair from his cat's tail. At the age of eighteen he established himself as a portrait painter in Philadelphia. In 1760 he went to Rome, where his *Cimon and Iphigenia* and *Angelica and Medora* received favorable comment. Three years later he went to England; and so cordial was his reception that he decided to make London his home. For King George III, his patron for more than thirty years, he executed a series of historical and religious paintings for Windsor Castle. On the death of Sir Joshua Reynolds, in 1792, he became president of the Royal Academy. The best of his historical paintings are *The Death of General Wolfe, Penn's Treaty with the Indians, The Battle of La Hogue* and *The Black Prince at Poitiers*. Among his religious pieces, the most notable is *Christ Healing the Sick*. Though he was not a great genius, West was a talented and painstaking painter, and is given credit for making improvements in the manner of treating historical subjects.

WEST CHES'TER, PA., the county seat of Chester County, twenty miles west of Philadelphia, on the Pennsylvania and the Philadelphia, Baltimore & Wilmington railroads. It is surrounded by an agricultural region, and large cream separator works and extensive nurseries are the most notable industries. The city is the seat of the West Chester State Normal School, one of the largest normal schools in the country, and of Darlington Seminary for young ladies and Saint Anthony's Boys' College. The Battle of the Brandywine was fought within four miles of West Chester, and the battlefields of Chadd's Ford and Valley Forge are within driving distance. The Old Turk's Head Hotel dates from pre-Revolutionary days. Population, about 15,000.

WESTERN AUSTRA'LIA, a state of the Australian Commonwealth, occupying all of that portion of the continent west of the 129th meridian, east longitude, and including adjacent islands. Its greatest extent from north to south is 1,480 miles, and from east to west, 1,000 miles. The area is estimated at 975,920 square miles, making it the largest of the Australian states. In this vast region the density of population is less than one to the square mile, as there are only about 581,000 inhabitants. No other Australian state is so sparsely populated.

The interior is a low plateau, varying in altitude from 700 to 1,000 feet and occasionally rising to greater height. It is mostly sterile, with little or no vegetation. Most of the eastern part of this division belongs to the great Victorian Desert. The western coast line is bordered by highlands or mountains, which are from 50 to 100 miles from the coast. These mountains also extend into the northern or Kimberly division. They are low, and their highest summits do not exceed 3,580 feet. The productive regions of the colony are in the west and southwest. Here there is sufficient rainfall to sustain vegetation, and there are extensive forests of eucalyptus, sandalwood and other Australian trees.

The lands are also well suited to grazing and agriculture. Wheat, barley, corn, oats, potatoes and hay are raised in paying quantities; apples, peaches, oranges, lemons, grapes and other fruits are also cultivated. Considerable livestock is raised and wool growing is an important branch of agricultural industry. Other resources of the state are timber and mineral wealth, the latter consisting largely of gold.

The government is similar to that of other Australian states. The governor is appointed by the British sovereign and the legislature consists of a legislative council of thirty members and an assembly of fifty members. The members of the council are chosen for six years, and of the assembly, for three years. Women vote on equal terms with men. Perth is the capital; with its port, Fremantle, its population is 235,000. See AUSTRALIA.

WESTERN RESERVE. In 1786, when Connecticut ceded to the United States government the western lands covered by its original charter of 1662, it retained a strip of land extending westward from the Pennsylvania boundary 120 miles, and called it the Western Reserve. Most of this tract was sold in 1795 and 1796 to the Connecticut Land Company, and the sum paid ($1,200,000) was used for Connecticut public schools. The new company surveyed the land, and settlers began to take homesteads and to develop it. Later the district became a part of the state of Ohio. The name of the reservation disappeared from geography, but survives in a university at Cleveland, which is situated in the district (see below).

WESTERN RESERVE UNIVERSITY, a nonsectarian institution of higher learning, founded in 1826 and located in Cleveland, Ohio. The university comprises thirteen colleges and a summer session. Undergraduate liberal arts, science and business administration are offered in Adelbert College for men, the Flora Stone Mather College for women and Cleveland College, the downtown coeducational school. Graduate work in arts and science and business administration is offered in the graduate school and in Cleveland College. Other graduate schools are the schools of medicine, law, applied social sciences, library science and nursing. Undergraduate professional work is offered in the schools of education, architecture, pharmacy and dentistry. The university library contains about 520,000 bound volumes. Including the summer session, the students number about 12,000; the faculty numbers about 750

WEST INDIES, *in′diz,* or **ANTILLES**, *an til′ leez,* an archipelago lying between North America and South America, and between the Gulf of Mexico and Caribbean Sea on the west and the Atlantic on the east. The islands cover a total area of about 92,000 square miles, but their surface area comprises only about 300 square miles. They are believed to be the summits of a subterranean mountain chain. Cuba, the largest island of the group, is independent; the Dominican Republic (formerly Santo Domingo) and Haiti, both on the same island, are self-governed states sometimes advised financially by the United States.

In 1940 the United States secured leases of sites for eight naval bases from Great Britain, in exchange for fifty destroyers. Five of these were in the West Indies: one each in the Bahamas, Jamaica, Trinidad, Saint Lucia and Antigua (in the Leeward Islands).

The islands belong to the following governments:

Great Britain: The Bahamas (twenty inhabited and many uninhabited islands); the Barbados; Jamaica and its dependencies, the Cayman Islands and the Guano Islands (Morant Cays and Pedro Cays); Turks and the Caicos Islands; Trinidad; the Leeward Islands, including Antigua, Saint Christopher (or Saint Kitts), Montserrat, Sombrero and the British Virgin Islands (about thirty in all); and the Windward Islands, including Grenada, Saint Vincent and the Grenadines (half under each of the two former), Saint Lucia and Dominica.

United States: Porto Rico, ceded from Spain in 1898; and the Virgin Islands, formerly the Danish West Indies, purchased from Denmark in 1917, and comprising Saint Thomas, Saint John, and Saint Croix (Santa Cruz).

France: Martinique; Guadeloupe, consisting of Guadeloupe and Grand-Terre, with five dependencies (Marie Galante, Les Saintes, Désirade, Saint Barthélemy, and Saint Martin, northern section).

Netherlands: The Netherlands Antilles consists of two groups of islands about 500 miles apart. One group includes Curaçao, Aruba, and Bonaire. Saint Eustatius, south Saint Martin, and Saba make up the other.

Venezuela: Margarita and neighboring islands.

Independent: Cuba and Isle of Pines, Haiti and the Dominican Republic. The island groups are described under their own titles.

Related Articles. Consult the following titles for additional information:

Bahama Islands
Barbados
Cuba
Dominica
Guadeloupe
Haiti
Jamaica
Leeward Islands
Martinique
Porto Rico
Saint Christopher
Santo Domingo
Trinidad
Virgin Islands of the United States
Windward Islands

WEST′INGHOUSE, George (1846-1914), an American inventor and engineer, the inventor of the air brake. He was born in Schoharie County, N. Y., and was educated in the public schools of Schenectady. His inventions include a device for replacing railroad cars on the track; the air brake, which he invented in 1868 and subsequently improved; and a number of signaling devices. Alternating-current machinery was introduced in America largely through his efforts. See Air Brake.

WESTMINSTER ABBEY

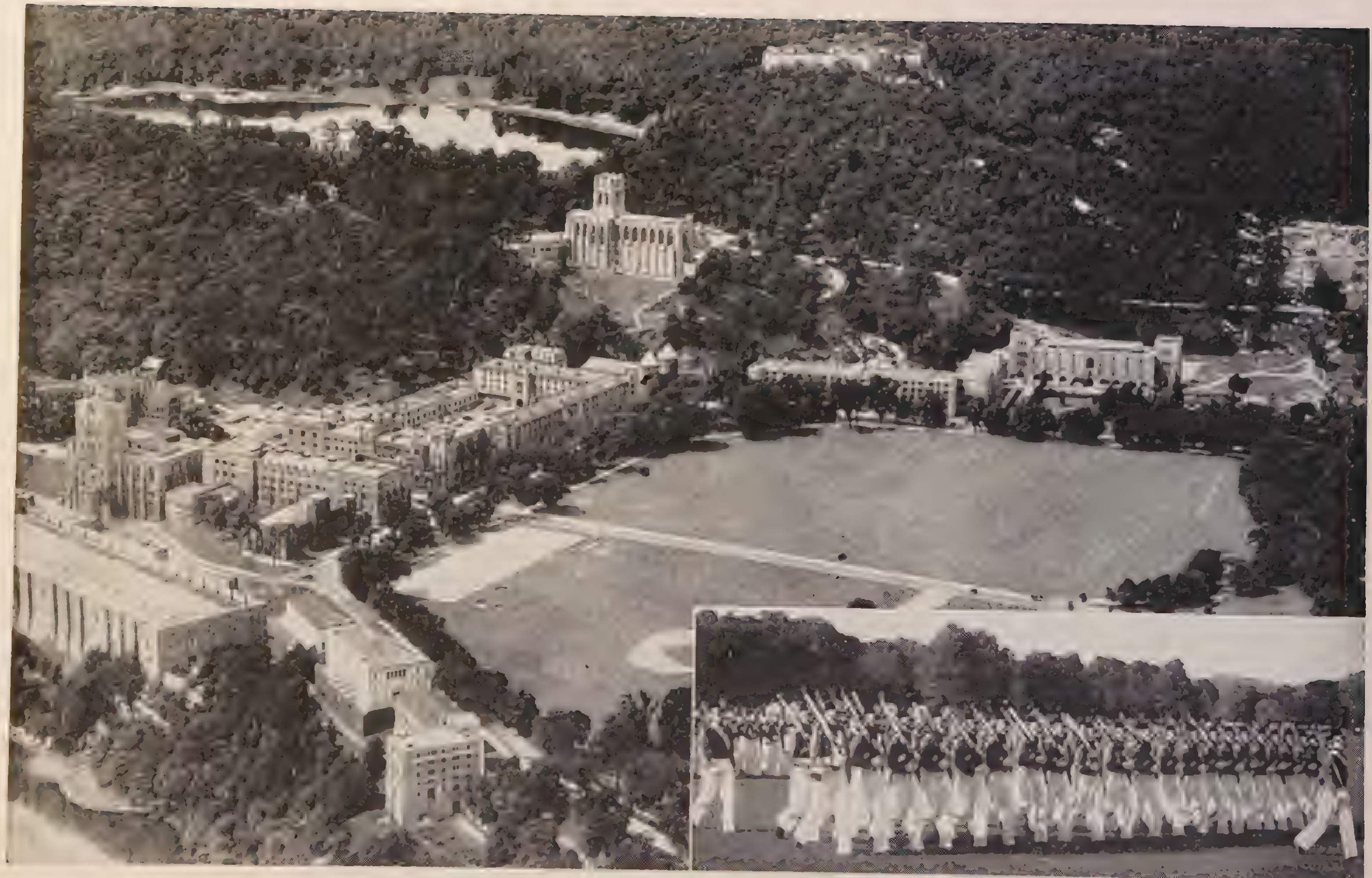
WESTMINSTER ABBEY, a famous church in London, called "Abbey" because up to the time of Henry VIII it was a Benedictine monastery, presided over by an abbot. It is situated near the Thames, adjoining the Houses of Parliament. In 1065 a church was built on the site, in the Norman style, by Edward the Confessor, but the main building, as it now stands, was begun in 1220 by Henry III and was practically completed by Edward I. Various additions were made down to the time of Henry VII, who built the chapel which bears his name. The upper parts of the two towers were designed by Sir Christopher Wren. The extreme length of the church is 423 feet, the roof is 102 feet high, and the towers are 225 feet. The coronation

Ewing Galloway

THE CHOIR OF WESTMINSTER ABBEY

THE CORONATION CHAIR

The oaken chair made to order of Edward I, to hold the famous "stone of destiny," on which the kings of Scotland had been crowned for centuries. The kings of England sit in this chair when crowned.



Ewing Galloway

STATELY BUILDINGS AND PARADE GROUNDS OF WEST POINT

Here, after years of severe training, second lieutenants are graduated for future service in the Army of the United States. The inset shows cadets marching with a precision that defies criticism.

of English kings takes place in the choir of Westminster Abbey, where the coronation chair is kept. Edward I had the chair built over the Stone of Scone, which he had brought to London in 1296, and which had been for centuries the Scottish coronation stone.

Burial in the Abbey is one of the greatest honors the nation can bestow, and not only sovereigns but some of the most celebrated men of science, soldiers, statesmen and men of letters are interred there. The chapel of Henry VII is reserved for the burial of royalty. In the Poets' Corner are interred England's great poets, including Chaucer, Tennyson and Browning. Many great poets not buried there are represented by memorial tablets or busts. Among these is a bust of Longfellow, the only American so honored. Westminster Abbey suffered bomb damage in World War II.

WESTMINSTER HALL, the hall of the old palace of Westminster, erected by Richard II on the foundations of a structure built by William Rufus, and for centuries the center of the English courts of law. It is 290 feet long, sixty-eight feet wide and ninety feet high; and it has a fine porch, and a roof of carved timber which is considered the most notable of its kind. This building is closely associated with many stirring events in English history. Here Chancellor More, Lady Jane Grey, the Earl of Strafford, King Charles I and Warren Hastings were brought to trial. It is connected with the Houses of Parliament. It escaped the fire of 1834, but suffered from bombing in World War II.

WEST ORANGE, N. J. See ORANGE.

WESTPHALIA, *west fa' li ah,* a small province of Prussia, mountainous as to its surface, rich in iron, coal, zinc and copper. The iron and coal areas are extensions of the great Ruhr mines. Westphalia leads all Germany in coal. There is also a large stone and salt industry. Plants for the manufacture of metal wares and machinery abound. Westphalia also manufactures quantities of linen, woolen and cotton goods. About forty per cent of the area is under cultivation, producing crops of rye, oats, flax, potatoes and wheat. Münster is the principal city.

Westphalia was retained as a part of Prussia in the formation of the new Republic of Germany. In 1923, France occupied the Ruhr district in this province, and after World War II Westphalia was included in the British zone of occupied Germany.

WESTPHALIA, PEACE OF, the treaty which closed the Thirty Years' War. Many states had been involved in this contest and two separate conventions were held to decide upon terms of peace. The representatives of the Empire, France and Spain and the Catholic electors and princes of the Empire met at Münster, and the representatives of Sweden, the Empire and the German Protestants at Osnabrück. Each of these conventions signed a treaty in 1648, and in October of that year the general treaty was signed at Westphalia, by the representatives of all the powers.

One of the important provisions of the treaty was the extension to the Calvinists of the religious liberty which had by the Peace of Augsburg been allowed only to the Lutherans. It was provided, also, that all territory which, in the Palatinate, Württemberg and Baden in 1618 and in the other states in 1624, had been held by Catholics, was to remain Catholic, and that all which at that time had been held by Protestants was to remain Protestant. A prince might make his religion compulsory with his subjects, but the latter had the right to emigrate if dissatisfied. The Upper Palatinate was added to the duchy of Bavaria; the Lower Palatinate was given to the son of the Elector Palatine, and Western Pomerania was ceded to Sweden. Brandenburg received certain cessions of territory to make up for the loss of Pomerania; France was given Alsace, with Metz, Toul and Verdun; Spain recognized the independence of the United Provinces of the Netherlands, and Austria recognized the independence of Switzerland. See THIRTY YEARS' WAR.

WEST POINT, N. Y., village in Orange County, on the west bank of the Hudson, fifty-five miles north of New York City, at the opening of the Highlands. The village is beautifully situated on an elevated plateau and is chiefly noted as the seat of the United States Military Academy, which occupies a site covering 2,300 acres (see MILITARY ACADEMY, UNITED STATES.)

In the early history of the country West Point was of considerable strategic importance, and during the Revolution it was fortified under the direction of the Polish engineer Kosciusko. It was given into the command of Benedict Arnold (see ARNOLD, BENEDICT), who treacherously attempted to surrender it to the British. It was selected as the site of the Academy by Congress in 1802.

WEST VIRGINIA, a state in the eastern mountainous region of the United States, belonging to the South Central group of states. It lies west of Virginia, of which it was originally a part, and is one of the foremost mining states in the Union. Its popular names are PANHANDLE STATE and MOUNTAIN STATE. The rhododendron is the state flower.

Location and Size. The state is irregularly oval in shape, with extensions to the north and northeast; it has no seacoast. Ohio, Pennsylvania and Maryland are to the north, and Kentucky and Virginia lie along its curving southern boundary. Ohio and Kentucky border it on the west. With an area of 24,181 square miles, of which 101 square miles are inland water, West Virginia is the fortieth state in the Union in size.

People and Cities. The population at the 1950 census was 2,005,552, an increase of 5.4 per cent over the number reported at the 1940 census. The state ranked twenty-ninth in population in 1950. It ranked thirteenth in density of population, with an average of 83.3 persons to the square mile. The majority of the people in West Virginia are native-born. Foreign-born groups include Italians, Poles, Hungarians, English, Germans, Czechoslovakians, Greeks, Yugoslavs, and Austrians. The chief religious denominations are the American (formerly Northern) Baptist, the Roman Catholic, and the Methodist.

The 1950 census reported an urban population of 34.6 per cent, and fourteen cities with populations of more than 10,000. The first ten cities in 1950 were: Huntington, 86,353; Charleston (the capital), 73,501; Wheeling, 58,891; Clarksburg, 32,014; Parkersburg, 29,684; Fairmont, 29,346; Morgantown, 25,525; Weirton, 24,005; Bluefield, 21,506; Beckley, 19,397.

Surface and Drainage. The surface as a whole is very uneven and in the eastern portion it is mountainous. The mountain region occupies more than one-third of the state, and the ranges extend in a northeast-southwest direction. Between the mountain ranges on the eastern and western sides are broad valleys, narrowing into ravines as they approach the hill region. The ridges in the eastern part are cut by numerous transverse valleys, and in the southern part these valleys are so numerous as to cut the mountain ranges into broad domes with spurs running in various directions, leaving but few definite ridges. The average elevation of the state, 1,500 feet, is the highest average of any state east of the Mississippi River. The highest point is Spruce Knob, in Pendleton County, which has an elevation of 4,860 feet, and the lowest point is Harper's Ferry, with an elevation of 260 feet. Some of the other prominent peaks are Bald Knob, 4,800 feet, and High Knob, 4,170 feet. West of the mountains there is a belt of broad, flat hills, ranging from 1,000 to 2,000 feet in elevation. These hills are followed by a more gently rolling country, sloping toward the Ohio River.

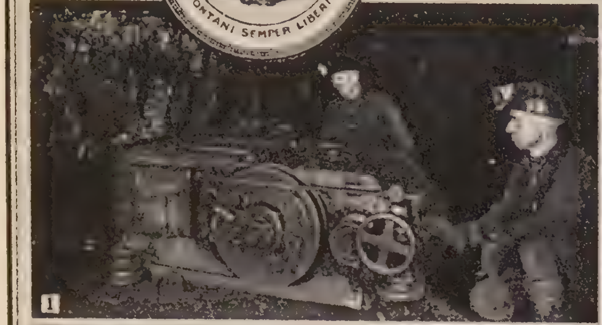
The Ohio River furnishes steam navigation along the whole western boundary and receives all the principal streams of the state, except the Potomac and its affluents. The largest rivers flowing into the Ohio are the Guyandot, the Kanawha, the Little Kanawha, the Big Sandy and the Monongahela. The Potomac's South Branch drains the northeastern section of the State.

Climate. The climate has seasonable variations ranging from 30° below to 100° above zero, the mean average temperature of the state being 56° F. The average rainfall in the highest elevation is 35 inches, in the lowest 55 inches, and for the state 43 inches.

Mineral Resources. Coal, natural gas and petroleum are the most valuable mineral products of this richly-endowed commonwealth. Possessing 17,280 square miles of bituminous coal, West Virginia surpasses Pennsylvania in extent of deposits and in the annual yield of this mineral. The production in West Virginia steadily increased

WEST VIRGINIA

THE PANHANDLE STATE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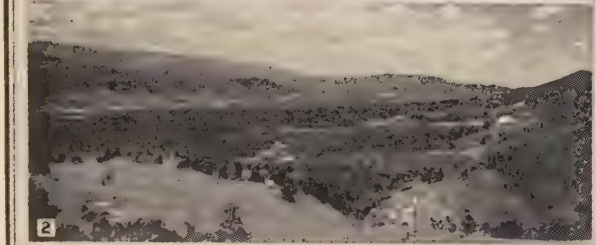
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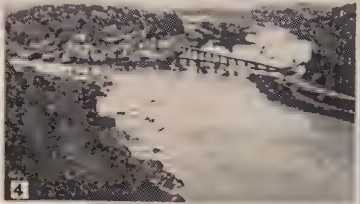
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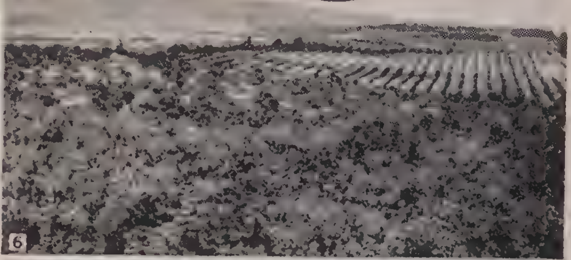
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Courtesy W. Va. Road Commission

(1) West Virginia leads all the states in soft coal deposits. (2) Scenic valleys are numerous. (3) Cattle on blue grass. (4) Old Harper's Ferry. (5) Harewood, home of Colonel Samuel Washington. (6) Fertile farm country. (7) The city of Charleston, the state capital.

for several years, but the output began to decline in the 1930's, because of the extensive use of other kinds of fuel and the development of hydroelectric power. The state produces no anthracite.

West Virginia has large deposits of natural gas, much of which is piped to cities of the state and to near-by industrial centers. Crude petroleum is another leading mineral. However, the development of the oil and gas fields of the Central West has reduced the rank of West Virginia in average production of these minerals.

Among other valuable products of the state are pig iron, sandstone, limestone, lime and salt. In average years West Virginia is the fifth state in mineral production.

Agriculture. Considering its mountainous surface, West Virginia ranks well as an agricultural state; about one-third of the whole land area is improved. The Ohio and the northeastern valleys are especially fertile. Corn is grown generally, and leads all other crops in production. Other profitable crops are wheat, oats, buckwheat, potatoes and tobacco. Sorghum cane is grown, and fruits thrive in various sections, especially in the panhandle regions. Apples, including the prized Grimes' Golden and Golden Delicious varieties, are the most important orchard crop, and peaches are second. Plums and grapes are also important fruits. Market gardening, stock raising and dairying are all carried on with profit.

Manufacturing. West Virginia has many natural advantages conducive to the development of manufacturing, such as an abundance of fuel, water power and good transportation facilities. It ranks high among the states in the manufacture of lumber and lumber products, one of its most important manufacturing industries. Wheeling, the principal manufacturing city, is the center of the iron and steel interests, one of the outstanding industries. West Virginia also ranks high in the production of lampblack, tanned leather articles, galvanized iron, coke, tin plate and terneplate. At Wheeling and other cities there are extensive glass factories, and at Charleston there is one of the largest ax factories in the world. Oil refining, pottery making, chemical production and the manufacture of tobacco products are also carried on.

Charities and Corrections. The charitable and correctional institutions include the Weston State Hospital, the Spencer State Hospital, the Huntington State Hospital, the State Tuberculosis Sanatorium, the Welch State Hospital, No. 1, McKendree Hospital, No. 2, the Fairmont Hospital, No. 3, the West Virginia Industrial School for Boys, the West Virginia Industrial Home for Girls, the West Virginia School for the Deaf and Blind, and the West Virginia Children's Home.

Transportation. The state secures water communication through the Ohio, the Monongahela and the Kanawha, which are navigable for large boats. Lumber was formerly floated down the Little Kanawha and the Big Sandy, as well as down the Ohio, which was used extensively to transport coal. Several trunk lines of railway traverse the state from east to west, one in the northern, another in the central and two in the southern section. Two lines extend north and south, connecting these in several places, and there are numerous cross lines and spurs, so that the northern and central parts of the state have good railway facilities.

Government. The legislature consists of a senate and a house of delegates, the former having thirty members, and the latter, ninety-four. One-half of the senators are elected every two years, for a four-year term, and the delegates are elected for two years. The legislature meets biennially, and the session is limited to forty-five days. The executive department consists of a governor, a secretary of state, a superintendent of free schools, a treasurer, an attorney-general and a commissioner of agriculture, each elected for four years. The courts consist of one supreme court of appeals, twenty-two circuit courts and thirty-eight courts of limited jurisdiction, together with courts of county commissioners, justices of the peace and municipal courts.

Education. Separate schools are maintained for white and colored pupils. The system of public instruction is in charge of a superintendent of free schools, and school attendance is compulsory for children between the ages of eight and fourteen. High school education is under the direction of a special supervisor. The higher institutions of learning include the West Virginia University, at Morgantown; the state teachers colleges at Athens, Fairmont, Glenville, Huntington, Shepherdstown and West Liberty; Bethany College; West Virginia

Wesleyan College, Buckhannon; Morris Harvey College, Barboursville; a normal school at Bluefield, for Negroes.

History. The state of West Virginia was, until 1863, a part of the state of Virginia. (For early history, see VIRGINIA, subhead *History.*) At the outbreak of the Civil War, many of the counties in the western part of that state had Union sympathies, while the remainder wished to secede and join the Confederacy. Therefore, in June, 1861, representatives of forty counties declared independence of the state of Virginia and organized a provisional government on a loyal basis under Francis H. Pierpont; representatives to Congress were elected and a constitution was adopted in April, 1862. Meantime, a "reorganized" provisional government of Virginia had given its consent to the formation of the state, and West Virginia was formally admitted June 20, 1863. It was the scene of some of the earliest fighting in the Civil War, and furnished far more than its quota to the Federal armies. After the war there was rapid development of the resources of the state and a great increase in population. West Virginia has enacted legislation to aid the aged, the blind, and dependent children and has liberalized its constitution in the interests of education.

Related Articles. Consult the following titles for additional information:

CITIES

Bluefield
Charleston
Clarksburg
Fairmont
Harper's Ferry
Huntington
Martinsburg
Morgantown
Parkersburg
Wheeling

MOUNTAINS AND RIVERS

Alleghany
Blue Ridge
Cumberland
Kanawha
Monongahela
Ohio
Potomac

WEST VIRGINIA UNIVERSITY, a coeducational state university, established at Morgantown in 1868, by the consolidation of the West Virginia Agricultural College, Woodburn Seminary and Monongahela Academy. It includes colleges of arts and sciences, engineering and mechanic arts, agriculture, medicine and law, schools of music, military science and tactics, and commerce. In 1928 a women's gymnasium was completed, also a field house for men, at a cost of $550,000. There are 300 instructors and about 3,000 students, including those in special departments and in the summer schools.

WEYLER Y. NICOLAU, *wa'lur e ne kolah'oo,* VALERIANO, Marquis of Tenerife (1838–1930), a Spanish general and administrator, born at Palma, Majorca. He received a military education in Spain, and was a military attaché of the Spanish legation in the United States at the time of the Civil War. He fought in Cuba under Balmaceda, from 1868 to 1878, and later in Spain against the Carlists. Afterwards he was successively governor of the Canary and the Balearic islands, and in 1889 he became captain-general of the Philippines. After later service as provincial governor of Catalonia, Spain, he became, in 1896, Spanish governor of Cuba. His administration there was marked by such harshness and cruelty that the United States protested, and in 1897 he was recalled. After the Spanish-American War he was for a time captain-general of Madrid.

WEYMAN, *wi'man,* or *way'man,* STANLEY JOHN (1855–1928), an English novelist, born at Ludlow, Shropshire, and educated at Oxford. He was admitted to the bar in 1881 and practiced for eight years. His first historical romance, *The House of the Wolf,* is a story of the French occupation of Quebec. *A Gentleman of France* established his reputation in the field of historical romance. Among other novels which brought him wide popularity are *Under the Red Robe, My Lady Rotha, The Man in Black* and *The Red Cockade.*

WHALE, a large marine animal, some species of which are the largest animals in existence. Even the prehistoric monsters of the Age of Reptiles did not equal the largest whales in length and weight. There is record of a specimen weighing eighty tons. The literature of the whaling industry is fascinating, and one story has become a classic—Herman Melville's *Moby Dick.* The scientific study of whales, including their life history, structural characteristics and classification, has greatly advanced since the advent of shore whaling and the erection of shore stations accessible to zoölogists. Though often classed as a fish, the whale bears only a superficial resemblance to the fishes. The tapering body terminating in a finlike tail and the fin-shaped paddle on each side of the body are the only points of similarity, but the dissimilarities are numerous.

The whale, first of all, is a mammal, bearing its young alive, and suckling it in infancy. It has well-developed brain and lungs, and warm blood, which circulates through veins and arteries. Its bones, joints and muscles are like those of the higher land mammals. The forelimbs contain the same bones as do those of other mammals. These are proportionately short, and, instead of toes, there is a paddle, about seven feet long, formed by a continuous skin; while in the rear part of the body are rudimentary bones which indicate the existence of hind legs in remote ancestors. The organ of locomotion is the fin-shaped tail, which is also used for purposes of defense. The whale is a timid creature and becomes combative only when attacked. When aroused it can capsize a large vessel with its tail, which is from five to six feet long and twenty to twenty-five feet broad, and destroy smaller craft by ramming it with its blunt nose.

Two distinguishing characteristics of whales are the proportionately large head, which is usually a third of the entire length of the body, and the thick layer of fat beneath the skin, which protects the animal from the cold. This fat, called blubber, is cut from the captured animal and reduced to oil. Before mineral oils came into general use, whale oil was burned in lamps in every part of the world.

The eyes of whales are small and there is usually only one nostril, frequently S-shaped, situated on top of the head. It is closed by a pluglike valve, opened only by pressure from inside. When the whale comes to the surface it expels the air from its lungs with great force through this nostril; and the hot, moisture-laden breath condensing in the cold air produces a column of vapor several yards high. The notion that a whale takes water into its mouth and blows it out through this hole is erroneous. The whale's mouth is large, but the throat is very small; however, a species known as the Greenland whale has a throat large enough to admit a man's body.

Whales usually are divided into two classes —the whalebone whales and those having teeth. The toothless whales are commercially the more important, and are hunted for both oil and whalebone, which latter is taken from the animal's mouth. The roof of the mouth is provided with vertical horny plates, called *baleen,* about 500 in number. These plates hang from the roof of the mouth in a fringe ten or twelve feet long. This equipment serves as a sieve for straining out the minute animals on which these whales feed. The surface waters of the ocean teem with animal life, and whales in feeding swim with open mouth at high speed near the surface, traveling in this way until hunger is satisfied. The manufacture of cheap substitutes for whalebone has greatly decreased the commercial importance of whalebone whales.

The toothed whales are the larger, attaining a length of ninety feet and a weight of seventy tons. The young when born are from ten to fourteen feet long. Of these the sperm whale is the most valuable. The blubber produces sperm oil, while the oil of the head yields spermaceti, used in making candles and cosmetics. Another valuable product of this whale is *ambergris,* found in the intestines and used in making perfumes.

Before the middle of the eighteenth century whaling was an important industry, but since the discovery of petroleum it has rapidly declined. Modern whaling operations are conducted with swift vessels, and the whales are killed by harpoons shot from guns. On every coast where whale fishing is conducted there are stations along the shore to which the carcasses are towed and cut up and prepared for market.

Related Articles. Consult the following titles for additional information, as well as the article Mammal:

Ambergris
Blubber
Cetacea
Spermaceti
Sperm Whale
Whalebone

WHALEBONE, *hwale'bone,* or **BALEEN',** a term applied to the horny plates attached to the palate of the toothless whale. They are arranged in a double row on the upper jaw and hang down parallel into the cavity of the mouth. The length of the plates varies from a few inches to twelve feet, and in number there are about 200 on each side of the mouth. The color varies according to the species, some kinds being black, some yellowish-white and others gray, striped with black or black and white.

This whale has no teeth, and this fringe of bony plates serves as a sieve or strainer of the animal's food which it takes in through wide jaws while traveling at high speed. From its strength, lightness and flexibility, whalebone has become an important article of commerce, being used for many purposes, as in the manufacture of corsets, ribs for umbrellas, whips and surgical instruments, though in some of these uses it has been largely superseded by steel.

WHARTON, Edith (1862-1937), whose maiden name was Edith Newbold Jones, was a distinguished American author. She received a private education and traveled widely. In 1885 she married Edward Wharton of Boston. After a number of her stories had appeared in *Scribner's Magazine,* she brought out a collection, *The Greater Inclination,* in 1899. *Crucial Instances* (1901) was a second collection. Her first novel, *The Touchstone* (1900), was followed by *The Valley of Decision* (1902) and *Sanctuary* (1903). *The House of Mirth* (1905) was her first great success. The majority of her works were concerned with the world of wealth and culture which she knew best, but in 1911 she published *Ethan Frome,* a powerful tale of frustration and tragedy in a poor New England family. This book was dramatized, as was also *The Old Maid,* a novelette from Mrs. Wharton's collection *Old New York* (1924). This play received the Pulitzer prize for drama in 1935. A novel, *The Age of Innocence* (1920), which was highly praised for its style and characterizations, was also awarded the Pulitzer prize. Other novels include *The Fruit of the Tree* (1907), *The Reef* (1912), *The Custom of the Country* (1913), *Glimpses of the Moon* (1922), *The Mother's Recompense* (1925), and *The Children* (1928).

Mrs. Wharton's works are stories of character. She presents intelligent, sensitive men and women in rebellion against social conventions and traditions. Although she wrote mainly of the rich and fashionable, her character studies have strength and depth, and she always avoids the trivial. Both her material and her technique resemble those of the great literary artist Henry James, and for most readers her style possesses greater clarity than his (see JAMES, HENRY). In later life Mrs. Wharton lived for many years in Europe. She was decorated for her activities in France during World War I. She tells the story of her life in *A Backward Glance* (1934).

WHEAT is one of the most valuable and widely grown cereal crops. It has been a basic food of mankind for countless centuries. Wheat grows readily in all climates except the hottest parts of tropical regions and the extremely cold parts of the frigid zones. It is best adapted to the temperate regions, and within these regions the greater part of the world's crop is grown. Wheat grows well in any fertile soil, and best in a good clay loam. Hot, dry weather during the ripening period is essential to the production of high-quality wheat. Wheat is therefore particularly well adapted to dry farming (see DRY FARMING). Wheat is supposed to be native to southwestern Asia, but it has been so generally cultivated for so many centuries that its place of origin is difficult to trace. The Spaniards introduced it into North America in the sixteenth century.

Kinds of Wheat. Wheat is a member of the grass family. Its fruits, or *kernels,* grow in dense heads at the tops of slender, hollow stalks. The most important species of wheat are common, durum, and club. *Common* wheat, the species most widely grown, may be bearded or bald (with or without hairlike bristles). Its kernels may be red or white, hard or soft. The hard wheats, highest in protein, are the best bread wheats (see GLUTEN). In the United States and Canada, common wheat is also classified as *spring* wheat and *winter* wheat. Spring wheat is sown in spring, winter wheat in fall. *Durum* wheat is a very hard wheat. It is used chiefly to make macaroni and similar foods. Durum is grown in the Dakotas and Minnesota. *Club* wheat, produced in the Pacific northwest, is a soft, white wheat that is used chiefly to make crackers and pastries.

Growing Wheat. Land to be sown with wheat is commonly plowed two or three months before the wheat is planted. Early plowing conserves soil moisture, helps keep weeds under control, and gives time for moisture and bacteria to break down the soil and take from it the foods that the plants can use. The seed is usually planted in rows by a grain drill, which places it in the soil instead of on top of it (see DRILL). The wheat may be harvested with a grain binder, which cuts it and ties it in bundles. The bundles are stacked in the field until the wheat has "cured" and is ready to thresh. It may also be cut by a header, which clips off only the heads of the plants. When the heads have cured, the kernels are removed by a threshing machine. In the United States, Canada, and other leading wheat-growing countries, most wheat is harvested with a *combine,* which both cuts and threshes the grain.

Production. Not counting the Soviet Union, for which no figures are available, the world's wheat crop amounts to six or seven billion bushels yearly. Of this the United States produces about one sixth. Canada, next in production, harvests about 500,000,000 bushels yearly. Argentina, western Germany, Italy, Turkey, Spain, Pakistan, Japan, and Australia are other leading wheat-producing countries. In the United States the leading wheat-producing states are Kansas, North Dakota, Montana, Oklahoma, Nebraska, and Washington. Saskatchewan produces about half of Canada's wheat crop. Alberta ranks second and Manitoba third among the provinces.

Uses of Wheat. Most of the world's wheat is milled into flour for use in bread and pastries. Part is made into breakfast foods, and a good deal is used in brewing, in the manufacture of whiskey, and in the production of industrial alcohol. Some is made into a starch that is used as a sizing in fabrics. Bran, shorts, and middlings, the by-products of flour mills,

After James Henry Breasted

WHEAT WAS THE GOLDEN GRAIN OF ANCIENT EGYPT. In this drawing from a stone carving, Egyptian farmers who lived over 3,000 years ago are shown plowing the ground and sowing wheat. The grain was scattered, or broadcast, from a bag strapped on the shoulders. Some farmers still use this method of sowing grain.

are used chiefly as stock feeds. Wheat straw is used as bedding for livestock and is made into paper and cardboard.

Diseases and Insect Pests. Rust, a fungus disease, is the worst scourge of wheatgrowers. Breeding resistant varieties has been the only effective way of controlling it. Smut is another destructive disease of wheat. The Hessian fly is the worst insect pest of wheat. The chinch bug, the wheat-stem sawfly, and the pale western cutworm also do great damage in wheat fields. See RUSTS; SMUTS; HESSIAN FLY; CHINCH BUG; CUTWORMS.

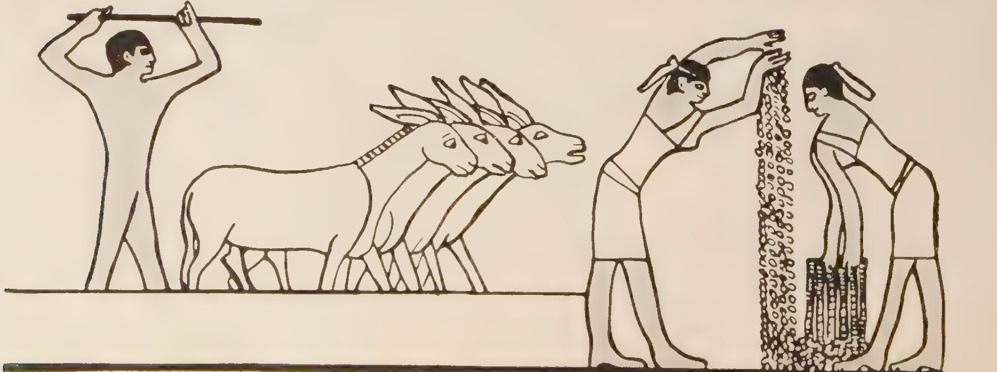
Marketing. Wheat produced in the United States is sold by the farmers to local grain elevators, from which it is sent to marketing and milling centers (see GRAIN ELEVATOR). At the elevators it is paid for on the basis of its quality as determined by inspection. In national and international trading, inspection by the buyers is impossible. To make fair trading possible, the Federal Government has set precise standards for wheat of various grades. Federal grain inspectors grade wheat to be shipped in national or international commerce. There are six classes of wheat: hard red spring, durum, hard red winter, soft red winter, common white, and club. Each class is divided into six classes according to the bushel weight of the wheat and its content of moisture, damaged kernels, and foreign matter. See BOARD OF TRADE.

International Wheat Agreement. The international wheat market has long been plagued by the problem of surpluses. The problem began in World War I, when the demand for wheat vastly stimulated production in the United States, Canada, Australia, and Argentina. After the war, when the demand declined, the world was producing too much wheat. European countries increased the problem by enlarging their wheat acreages so as to become less dependent on other countries. By 1930, overproduction lowered prices to ruinous levels. In 1933, exporting and importing countries signed an agreement intended to regulate wheat exports and prices. The wheat shortage caused by the drought in many countries killed the agreement. In 1938, when production again became normal, the United States Government began the policy of helping to maintain wheat prices by making loans to farmers on wheat in storage and of buying wheat so as to support its price at a certain level.

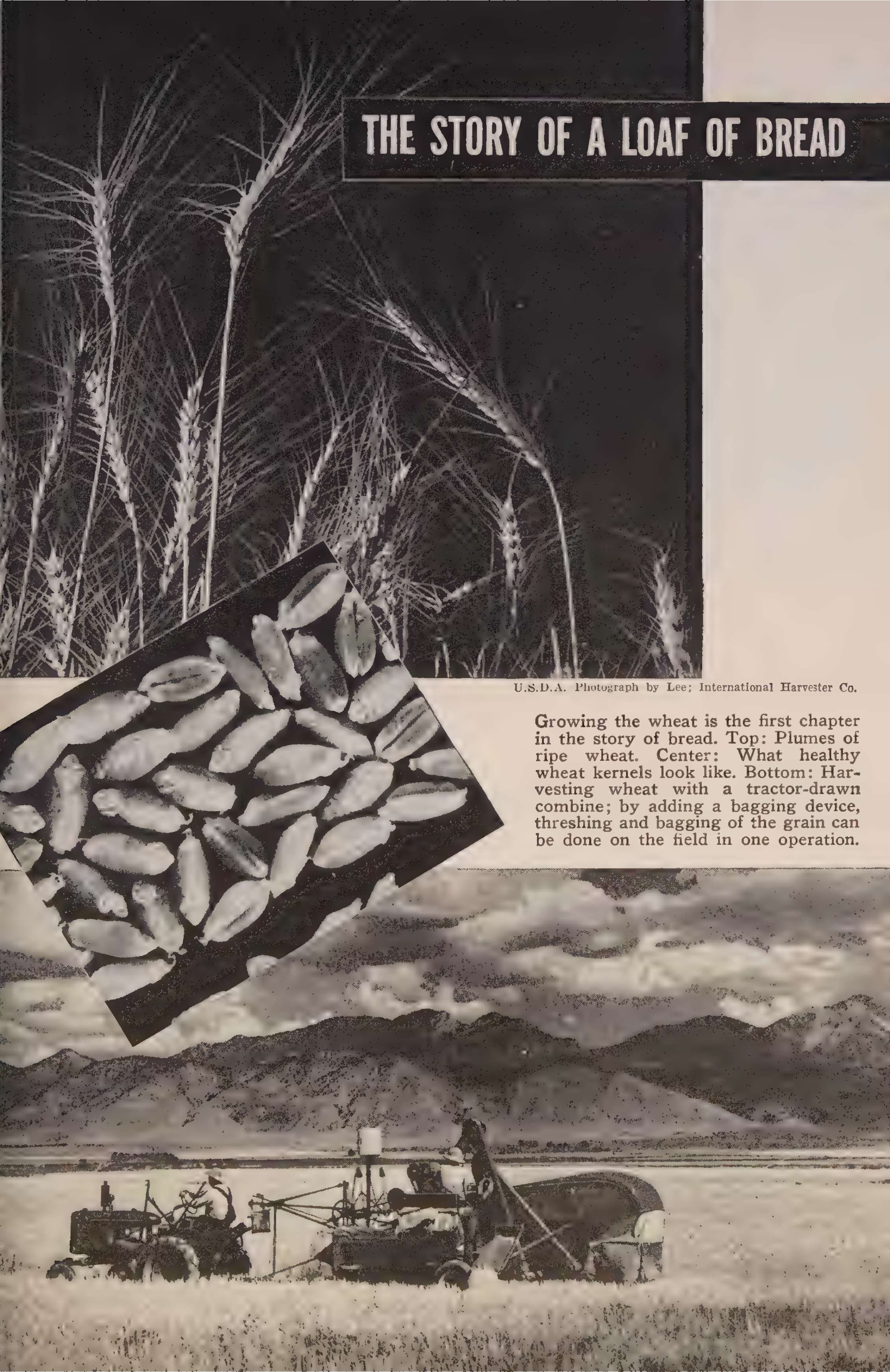
World War II again stimulated the demand for wheat. But after the war the surplus problem returned, larger than ever. In 1949 most exporting and importing countries — Argentina and the Soviet Union were the outstanding exceptions — adopted the International Wheat Agreement, which was intended to stabilize prices and supplies on the international market. Five exporting countries, the United States, Canada, Australia, France, and Uruguay, agreed to sell 456,000,000 bushels of wheat yearly at not more than $1.80 a bushel for four years. Thirty-six im-

EGYPTIANS THRESHED WHEAT by driving donkeys over the stalks of grain or by beating out the kernels with sticks. Then the grain was tossed in the air, or winnowed, to remove the hulls and chaff.

From Mummies by Richard A. Martin, Chicago Natural History Museum



THE STORY OF A LOAF OF BREAD

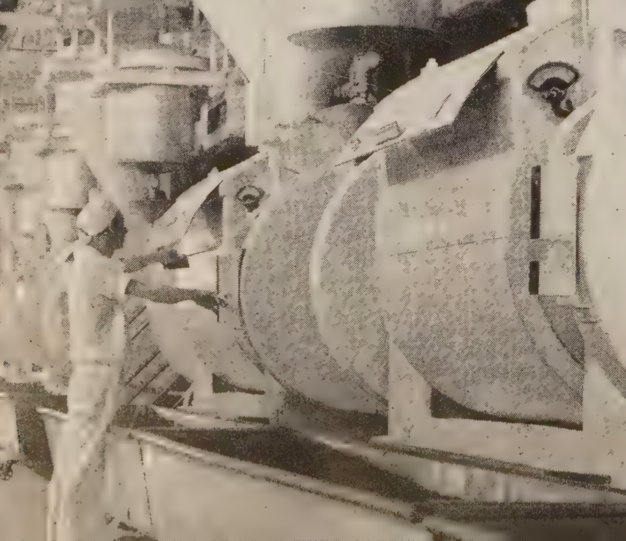


U.S.D.A. Photograph by Lee; International Harvester Co.

Growing the wheat is the first chapter in the story of bread. Top: Plumes of ripe wheat. Center: What healthy wheat kernels look like. Bottom: Harvesting wheat with a tractor-drawn combine; by adding a bagging device, threshing and bagging of the grain can be done on the field in one operation.

adian National Ry.; Syracuse University; Bond Bread Bakers

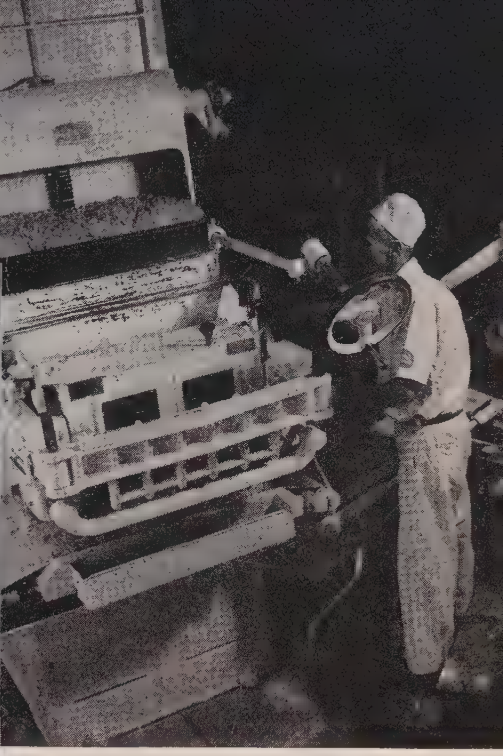
The harvested wheat is stored in huge grain elevators, like the one above at Churchill, Manitoba, until it is ground into flour. Careful scientific tests are made not only of wheat flour, but also of flour from soybeans and sweet potatoes (right).

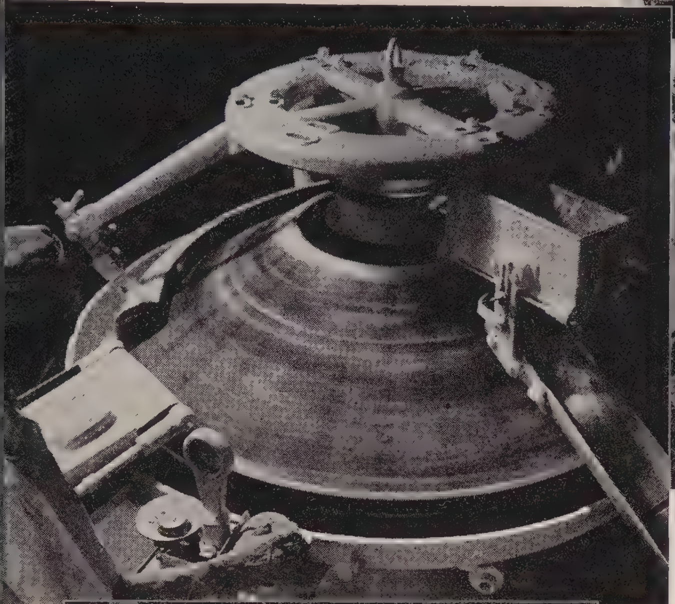


One of the first stages in bakin bread for the market is mixing th dough. Each one of the giant mixing machines at the left mixe enough dough in one operation t make a thousand loaves of bread

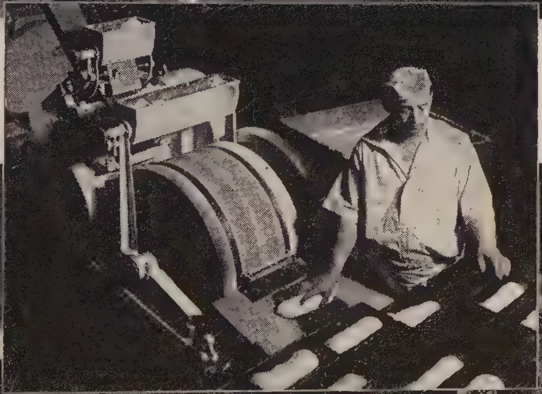
After the mixing, and when it has risen, the dough is carried to a divider (right), which cuts it into small pieces, each one just the right size to make a loaf of bread. The rounder (below) shapes these pieces into round, flour-sprinkled balls. These balls then go to the proofer for rising.

Bond Bread Bakers

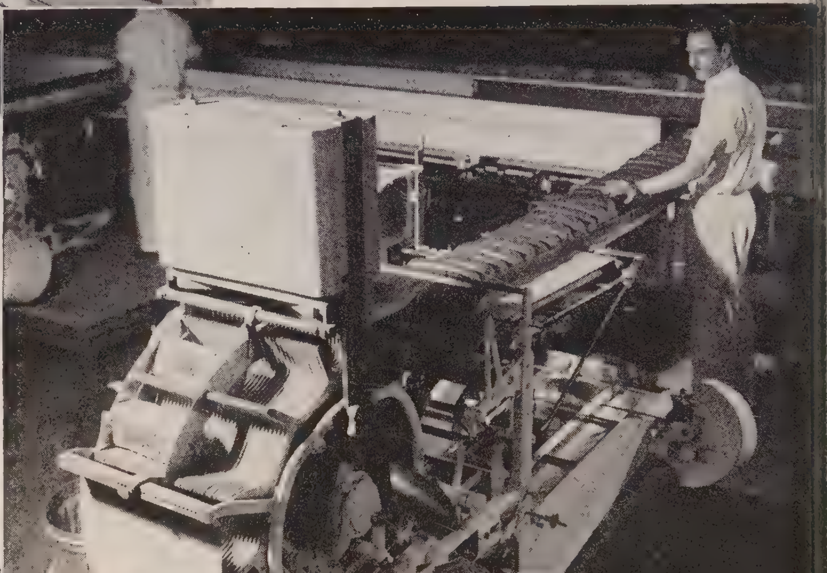




From the proofer, they go to the molder, which kneads them and shapes them for the pans (left). The pans then go back to the proofer for a second rising before being baked. The loaves travel slowly through the long ovens (below); they emerge baked.



The freshly baked loaves of bread are taken from th block-long ovens to cooling racks, from which travelling belts (left) carry them to the slicing and wrapping machines. Along the way, the loaves receiv careful inspection.



The loaves are taken from the traveling belt and placed in the slicer (right). They are then ready for wrapping—the final operation in preparing the bread for market.

Trucks then speed the freshly baked loaves from the bakery to the food stores which supply our tables each day with this vital and nourishing food.

porting countries agreed to buy the wheat at a minimum price of $1.50 a bushel in 1949-50, the price declining ten cents yearly to $1.20 in 1952-53. When the Korean War sent wheat prices soaring, the Federal Government had to pay American exporters a subsidy of 62 cents a bushel, the difference between the maximum export price and the domestic market price.

In 1953 the agreement was extended for three years. The maximum price was set at $2.05 a bushel, the minimum price at $1.55. A guaranteed quota of 595,000,000 bushels, about 60 per cent of the wheat and flour involved in international trade, was set. The United States was given an export quota of 270,000,000 bushels, Canada one of 250,000,000 bushels. The largest import quotas in bushels, were: Great Britain, 117,000,000, and West Germany and India, 55,000 bushels each.

WHEAT′STONE, Sir Charles (1802-1875), was an English physicist and inventor. Wheatstone was one of the pioneer researchers in electrical telegraphy. He was born in Gloucester and began his career as a maker of musical instruments. But this work did not satisfy his curiosity, his ingenious imagination, or his keen interest in science. He soon began carrying out experiments that had little connection with his vocation. By 1829, when he invented the concertina, he was already known as a gifted scientist. Five years later he was made professor of experimental philosophy at King's College, London, and in 1837 he became a fellow of the Royal Society. About this time he and William F. Cooke patented an electrical telegraph.

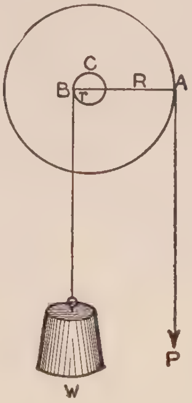
The telegraph he and Cooke invented remained in use for some time, though it was never so satisfactory as Morse's later invention. His investigations of binocular vision led to the invention of the stereoscope, used for viewing pictures with three-dimensional effect. Modern viewers for stereophotographs are made on the same principle as the stereoscope. Wheatstone also made important contributions to the science of spectrum analysis.

Wheatstone invented much telegraphic equipment and collaborated with others in improving the telegraph and increasing its usefulness. He measured the velocity of electricity through conductors and made use of the device for measuring the resistance of conductors which is known as the *Wheatstone bridge*. Oddly enough, Wheatstone, one of the most prominent inventors of his time, did not actually invent this device.

WHEEL. The invention of the wheel was one of the most important events in the history of mankind. The wheel immediately made it possible to move heavy weights with greater ease, and it later led to other fundamental inventions. From it came the potter's wheel, the spinning wheel, the pulley, gears, and the energy-storing flywheel. The Sumerians used wheels five thousand years ago, but whether they were first to do so is not known. It is believed that the wheel was developed from the rollers, such as logs, that were used in moving heavy burdens. Men eventually discovered that the roller would move more easily if its central part were cut away so as to form an axle with a disk at each end. Later they learned to cut slices from logs and fit axles through holes made in the middle of the slices. Still later they were able to make a large disk wheel from planks. Finally they learned how to build a wheel with a hub, spokes, and rim. See also Transportation, *History*.

WHEEL, an instrument of torture, employed by the Greeks and Romans and later in Western Europe. "Breaking on the wheel" was instituted in France in 1534 and was abolished in 1789. Assassins, highwaymen, incendiaries and pillagers of churches were of the classes so punished. There were several modes of wheel torture. Sometimes the victim's bones were broken, and his body was then bent around a wheel, bound and left until death ensued, perhaps in twenty-four hours. To terminate sooner the victim's sufferings the executioner sometimes dealt him two or three heavy blows, called *coups de grace* (mercy strokes), on the chest or stomach.

WHEEL AND AX′LE, a continuous lever of the first class, consisting of a wheel and axle fastened to the same axis (see Lever). The radius of the wheel is the power arm and the radius of the axle the weight arm of the lever. The law of equilibrium is that the power multiplied by the radius of the wheel is equal to the weight multiplied by the radius of the axle. In the diagram, *A* represents the circumference of the wheel, *C* is the circumference of the axle, *R* the radius of the wheel, and *r* the radius of the axle. If the wheel has a diameter of three feet, and the axle has a radius of one foot, a power of one pound will balance a weight of three pounds. In making the computations, the same results are obtained, whether the radius of the wheel is compared with the radius of the axle, or the diameter of the wheel with the diameter of the axle. The most common use of the wheel and axle is in the windlass, for raising water. Here the crank often takes the place of the wheel, but the device operates on the same principle.



Combinations of the wheel and axle in which toothed wheels mesh into one another and are driven by a crank or an endless band, occur in machinery where great power is required. Derricks and the shears used for cutting iron bars and plates afford good illustrations of these combinations.

WHEELER, Benjamin Ide (1854-1927), an American educator, born at Randolph, Mass. He was educated at Colby Academy and Brown University and spent four years of study in the universities of Leipzig, Heidelberg, Jena and Berlin. He taught in the Providence High School, Brown University and Harvard and in 1886 became a professor in Cornell University, holding, successively, the chairs of comparative philology and Greek. From 1899 to 1919 he was president of the University of California. His written works include *Analogy and the Scope of its Application in Language, Introduction to the Study of the History of Language* and *Principles of Language Growth.*

WHEELER, Burton Kendall (1882–), an American Senator, prominently identified with the Liberal wing of the Democratic party. He was born in Hudson, Mass., and was educated for the law at the University of Michigan, beginning practice in Butte, Mont. As an appointee of President Wilson, Wheeler served as United States District Attorney from 1913 until his election to the United States Senate, in 1922. He was reelected in 1928, 1934 and 1940. In 1924 Senator Wheeler was the Vice-Presidential candidate on the Progressive ticket with Senator LaFollette. He led the opposition to President Roosevelt's foreign policies after the outbreak of war in Europe.

WHEELER, Joseph (1836–1906), an American soldier, born at Augusta, Ga. He was educated at the West Point Military academy, was appointed lieutenant of cavalry and served in New Mexico. When the Civil War broke out he joined the Confederate army. He was rapidly promoted, attaining the rank of lieutenant-general. He took part in the Battle of Shiloh, rendered distinguished service at Chickamauga and impeded Sherman on his march through Georgia and South Carolina. After the war he settled in Alabama, and in 1880 he was sent to Congress. He represented his district until 1898, when he reëntered the United States army as major-general of volunteers to the great delight of all America, with command of the cavalry in the Army of Santiago. He rendered valiant service in the battles of Las Guasimas and San Juan Hill, and he was senior member of the commission which arranged for the surrender of Santiago. Later he served in the Philippines, until he was retired in 1900.

WHEELER, William Almon (1819-1887), an American statesman, born at Malone, Franklin County, N. Y. He studied for a time at the University of Vermont, studied law in his native town and was admitted to the bar. Later he engaged in banking. He was a member of the state legislature for two terms, and in 1860 he was sent to Congress, where he served continuously until 1877. He was nominated for the Vice-Presidency by the Republican party in 1876 and was elected with President Hayes. He returned to Malone at the expiration of his term in 1881. Wheeler rendered invaluable service to his country during reconstruction days by his conciliatory attitude as chairman of the committee on Southern affairs.

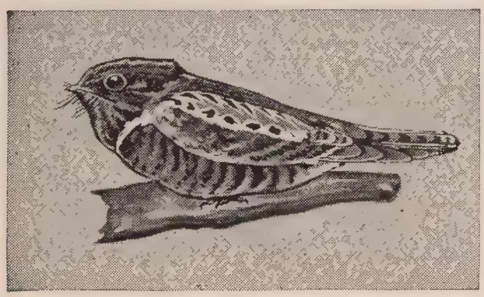
WHEELING, W. Va., county seat of Ohio County, sixty-three miles southwest of Pittsburgh, Pa., on the Ohio River and on the Pennsylvania, the Baltimore & Ohio and the Wheeling & Lake Erie railroads. Other transportation facilities include regular air service, river boats and bridges connecting with various points in Ohio and with Wheeling Island, a residential ward of the city built on an island in the Ohio River. The region is rich in coal, oil and lumber, and there is water commerce in iron ore, produce, fruit, cattle and poultry. The principal manufactures are steel, ceramics, glass, tobacco, textiles and metal products. The city has one of the largest electric power plants in the world and the Market-Auditorium, which combines an up-to-date market with a convention hall. A state teachers college and Bethany College are not far distant.

Wheeling was settled by Ebenezer Zane in 1769, and was the first town on the Ohio River. The town grew up about Fort Henry, built here in 1774; it was incorporated in 1806 and chartered as a city thirty years later. In 1818 Wheeling was made the western terminus of the National Road. The people of Virginia who were opposed to secession met here in 1861 and established "the restored government of Virginia." Two years later Wheeling was the scene of the convention which resulted in the separation from Virginia and the establishment of the new state, and the city was the state capital from 1863 to 1870 and from 1875 to 1885. The government is by city manager and a council elected by proportional representation. Population, about 59,000.

WHIG, in English history, the name formerly applied to the political party advocating changes in the constitution in the direction of democracy. The term is of Scottish origin, but was early brought to England, where it was used as the name of the political party opposed to the *Tories,* or government party. The term *Liberals* is now generally applied to the representatives of the party formerly known as *Whigs.*

The Whig party in the United States opposed the Democratic party from about 1835 to 1856, when the Northern wing of the Whigs was merged in the new Republican party. See POLITICAL PARTIES IN THE UNITED STATES.

WHIP′POORWILL, a North American bird of the goatsucker family. The name is an imitation of the bird's peculiar call of three shrill notes ending in a rising inflection. This weird cry is repeated many times in close succession. The whippoorwill makes its home in the midst of thick woods, rarely visiting the haunts of men. It is active at night, feeding on night insects, which it catches on the wing. During the day it sits lengthwise on a limb, where, owing to its mottled plumage, it is not easily seen.



WHIP-POOR-WILL

WHIRLPOOL, *whurl′pool,* a body of turbulent water with a spiral movement due to the shape of its channel, to meeting currents or to the conflict of winds and tides. Small whirlpools occur in rivers and are caused either by the forcing of the current into a circular core in the channel or by an opening in the bank of the stream which draws the water down to a lower level. Sometimes the position of rocks and the direction of currents in the sea cause large and dangerous whirlpools. The most noted of these is the Maelstrom, off the coast of Norway, and the Charybdis, near Sicily. The most celebrated river whirlpool is that of the Niagara River, below the falls.

WHIRL′WIND, a sudden and swift spiral movement of the free air of the atmosphere, either the small eddy of the city street which whirls leaves and dust and other light objects about in it, or the more extensive whirls of the deserts and plains. Very powerful whirlwinds are called cyclones or tornadoes. Whirlwinds are caused by the meeting of currents of air, or the collision of currents moving in opposite directions, and except in the case of the small eddies, they all take the same direction—counter clockwise in the northern hemisphere, and clockwise in the southern hemisphere, being governed by the vast planetary movements of the atmosphere. See CYCLONE; TORNADO.

WHIS′KY, a spirituous liquor, distilled chiefly from the fermented mash of cereal grains. There are two main varieties of whisky, called malt whisky, in which malt predominates, and grain whisky, in which unmalted grains predominate. The latter was formerly manufactured almost exclusively in the United States, rye and Indian corn being chiefly employed.

In the making of whisky several processes are necessary to convert the starch of the grain into sugar and the sugar into alcohol. The grain is ground, and the starch is cooked in a steamer for several hours to render it soluble. It is then added to the malt, and the mixture is kept at a temperature of 145° F. for about four hours. This saccharine infusion, called *wort,* is then drawn off, yeast is added, and the wort is allowed to stand from three to nine days to ferment. The liquid thus prepared for distillation is technically known as *mash.* It is placed in a metal container called a *still,* subjected to high temperature, and the vapors pass off through a spiral tube known as a *worm* and are condensed. Whiskey requires a period of storage in wooden casks to bring about the changes which develop its aroma and make it palatable.

Related Articles. Consult the following titles for additional information:

Distillation	Prohibition
Malt	

WHISKY INSURREC′TION, the name given to a revolt against the Federal government in Western Pennsylvania in 1794. It was the result of the excise law passed by Congress in 1791, imposing a tax on whisky. This tax was a peculiarly heavy burden to the people of Western Pennsylvania, most of whom were dependent for support largely upon the manufacture of whisky. They successfully resisted the attempts of the government to collect the tax and haughtily rejected the offer of amnesty in return for a promise of submission. Finally, in October, 1794, Washington sent 15,000 militia to the scene of the disturbance, and the insurrectionists promptly subsided. Two of the leaders were found guilty of treason, but President Washington pardoned them.

WHISKY RING, a term given in American history to a combination of distillers and Federal revenue collectors, who in Grant's administration conspired to defraud the government of the excise tax on whisky. This "ring" began operations in Saint Louis, where the revenue officers, having knowledge of technical violations of the law, blackmailed the distillers, under threats of prosecution. The decline in the revenue receipts was immediately noticeable, but all efforts at finding the conspirators failed, on account of the presence of their friends in the Treasury Department at Washington. It was only after the most thorough investigation by Benjamin H. Bristow, Secretary of the Treasury, that evidence sufficient to convict was found. The disclosures implicated the chief clerk of the Treasury Department and O. E. Babcock, President Grant's private secretary, but neither was convicted. About two hundred forty distillers and revenue officers pleaded guilty or were convicted in court, but most of the leading ones were pardoned. The total amount of which the government was defrauded was $1,650,000.

WHIST, a well-known game at cards, first clearly described by Edmond Hoyle, in his *Short Treatise on the Game of Whist* (1743). The game is played with the full pack of fifty-two cards, by four persons, two being partners against the other two, each player receiving thirteen cards, dealt out one by one in rotation. The last card dealt is turned face up and is called the trump card; it gives a special power to the suit to which it belongs. The cards rank ace (highest), king, queen, knave, and the others rank according to their number of spots. Play is commenced by the person on the left hand of the dealer, who lays down a card face up on the table; the other players follow in succession, with cards of the same suit, if they have them. When all have played, the player who has laid the highest card takes the four cards laid down, which constitute a trick. The winner of the trick then leads, as the first of a new trick, the winner of which becomes the leader, and so on. When a player cannot play a card of the same suit, he may play one of the trump suit and take the trick, or he may lay one of a different suit, which gives him no chance of winning the trick. When the hand is played out, the score is taken as follows: The partners who conjointly gain the majority of tricks score 1 point for every trick taken above six. The ace, king, queen and knave of the trump suit are called honors, in some systems of play, and count 1 each for the side who holds them; if one side hold three honors, they count 2 by honors, as the opposite side can have but one honor; if one side hold all the honors, 4 by honors is counted; should the honors be equally divided, neither side counts. In *long whist,* ten of these points make a game. In *short whist,* the number has been reduced to five, and in this form it is common to count by tricks alone. A rubber consists of a series of three games and is won by the side that secures two of them. In *duplicate whist* the game is played with as many sets of cards as desired. Each hand, as it is played, is laid aside, and at the close of the series of games the hands are exchanged, so that each game is played a second time, partners playing the hands of their opponents. The side that makes the greater number of points in the series wins.

Auction Whist, or **Auction**, as it is now commonly called, is a development of the game of whist, following a process of evolution, the first stage of which was known as Bridge Whist, or Bridge, now practically discarded. The game is played with a full pack of fifty-two cards, as in whist, by four persons, two being partners against the other two, and the cards having the same value as in whist. The trump suit is determined by bidding, the dealer having the first bid. Each player may bid or pass to the player on his left, as the strength of his hand warrants. The value of the suits, both for bidding and for counting in the score, is, Clubs, 6; Diamonds, 7; Hearts, 8; Spades, 9. A player may bid "No Trump," in which case and if so played, all suits have an equal value, and each trick over six counts 10. For example, if a player bids, "one heart" indicating he is prepared to play the hand with hearts as trumps, and to make seven or more tricks, the next bidder must bid "one spade," "one no trump," these bids indicating a higher value, or "two" or more of same suit, which means a larger prospective gain than "one heart," if successful. The player making the highest bid secures the privilege of playing the hand at his choice of trump, or "no trump." The player at the left of the successful bidder (the "declarer") leads the first card, and the declarer's partner places his hand face up on the table, in view of all the players. The declarer plays the exposed hand as well as his own.

Scoring. Each trick over six (a "book") counts, with clubs, six points; with diamonds, seven points; with hearts, eight points; with spades, nine points; with no trumps, ten points. The side first scoring 30 points wins the game. Two games won out of three constitute a rubber.

Honors	Clubs	Diamonds	Hearts	Spades	No Trumps
Three honors, called "Simple"	30	30	30	30	30
Four honors, in two hands	40	40	40	40	40
Four honors, in one hand	80	80	80	80	100
Four honors, in one hand and fifth in partner's	90	90	90	90	
Five honors, in one hand	100	100	100	100	

Beside the point score, which determines games and rubbers, an "honor" score is kept, and is added in when the final score is reckoned up at the end of the rubber to determine the winner. The honor cards are the ace, king, queen, knave (or jack) and ten of the trump suit. If the declaration is "no trumps," the four aces are counted honors.

Contract Bridge, or Contract. This is a development of Auction, differing from the latter in two important respects: (1) in the bidding, the object is to contract, if possible, for game or slam, the successful declarer not being entitled to claim on his point score more than he bids, and suffering a penalty if he fails to make his contract; (2) the scoring is in much larger figures than in Auction, and the penalties for failure to make the bid are much more severe. In bidding, the value of the suits follows the same order as in Auction, but in counting points, clubs and diamonds are known as minor suits, counting 20 each, hearts and spades as major suits, counting 30 each. 100 points constitute game. The method of play and the rules are set forth in convenient manuals prepared by leading exponents of the game.

WHISTLER, *whis'lur,* JAMES ABBOTT MCNEILL (1834-1903), an American painter and etcher. He was born at Lowell, Mass., of a prominent family, his father being a distinguished engineer in the United States army. The son was sent to West Point Military Academy, but after three years of uncongenial study he turned to art. He studied in France and England, and in time established a reputation as an etcher, taking rank with the greatest of etchers, Rembrandt. He became famous also for his paintings, pastels and lithograph drawings, which were marked by a unique originality. As a draughtsman Whistler was a consummate master, but in his pictures form was subordinated to color.

Whistler called his paintings nocturnes, symphonies, arrangements. They were executed in one color tone or two related tones, always in a subdued key. His London scenes, under cover of the night or fog, Venetian sketches and studies of the sea, are expressions of poetic moods rather than representations of actual scenes. Whistler's eccentricities brought him into continual conflict with artists and critics, who learned to fear his keen wit and incisive satire.

After 1859 Whistler lived chiefly in London and was for a time president of the Royal Society of British Artists. His best-known painting is a portrait of his mother, in the Luxembourg gallery, Paris. His etchings and paintings form a part of the permanent collections of all the greatest galleries. The best collection of his work is in the National Gallery, Washington, D. C. The artist possessed an unusual gift of literary expression and wrote, among other things, *Ten O'clock,* and *The Gentle Art of Making Enemies.*

WHITE, according to the theory of color, is that color which is a combination of all the colors of the solar spectrum—violet, indigo, blue, green, yellow, orange and red. The observer watching a beam of sunlight passing through a glass prism can see these colors, and they are also beautifully apparent in the rainbow. In practical usage a pure white pigment cannot be obtained by mixing together pigments corresponding to the seven spectrum colors, for pure pigments cannot be secured. Though white is called a color, in reality it is the presence of all colors. See COLOR; LIGHT.

WHITE, ANDREW DICKSON (1832–1918), an American educator, author and diplomat, born at Homer, N. Y. He was educated at Yale, the College of France and the University of Berlin. For a time he was professor of history and literature in the University of Michigan, and when Cornell University was founded he was chosen its first president. He retained the position for eighteen years, and when he resigned he bequeathed to the institution his historical library of 30,000 volumes. In recognition of this and other bequests, the departments of history and economics at Cornell were reorganized as the White School of History and Political Science.

In the course of his college presidency, Dr. White rendered important service to the government. He obtained leave of absence and was United States minister to Germany from 1879 to 1881. After he severed his connection with the university, he served the government in several important diplomatic posts: as minister to Russia, as one of the commissioners to investigate the Venezuela boundary, for five years as ambassador to Germany, and as president of the United States delegation to the Hague Peace Conference.

He was the author of numerous works on political and diplomatic subjects and of a large number of magazine articles. Among his most important works are *The Warfare of Science against Theology, Studies in General History, The New Germany, The European School of History, Chapters from My Diplomatic Life* and *Seven Great Statesmen.*

WHITE, EDWARD DOUGLASS (1845–1921), an American jurist, Chief Justice of the United States Supreme Court. He was born at Lafourche, La., educated at Mount Saint Mary's in Maryland, at the Jesuit College in New Orleans and at Georgetown (D. C.) College. He served during the Civil War in the Confederate Army. After the war he studied law, was admitted to the bar, entered politics and was state senator from 1874 to 1878. From the latter date until 1891 he was an associate justice of the Louisiana Supreme Court. After three years' service as United States Senator he was appointed Associate Justice of the United States Supreme Court, becoming Chief Justice in 1910, by appointment of President Taft.

WHITE, RICHARD GRANT (1821–1885), an American scholar and critic. He was educated for the law, but his literary tendencies turned him from a legal career, and his writings on Shakespeare soon made him recognized as one of the most prominent of Shakespearean scholars. Among his works are *Words and Their Uses, Everyday English, England Without and Within* and *Studies in Shakespeare.*

WHITE, STEWART EDWARD (1873–1946), an American novelist, born in Grand Rapids, Mich., and educated at the University of Michigan. He spent his boyhood among the rivermen of Michigan and early acquired a liking for the forest, which he has so vividly described in *The Forest.* He wrote many short stories, as well as novels. Among his books are *Lions in the Path, Back of Beyond, Why Be a Mudturtle, The Long Rifle, Ranchero, Dog Days, Wild Geese Calling, The Road I Know, Speaking for Myself* and *The Stars Are Still There.* His most famous book was *The Blazed Trail.*

WHITE, WILLIAM ALLEN (1868–1944), an American journalist and writer, born at Emporia, Kan., and educated at Emporia College and the University of Kansas. In 1895 he became owner and editor of the Emporia *Gazette,* which, under his management, became noted for the excellence of its policies and editorials. One of these, "What's the Matter With Kansas?", gained wide publicity. In 1912 White served as chairman of publicity of the Progressive National Committee. He was a member of the National Institute of Arts and Letters. As a penetrating observer and critic of the times, White held a foremost position. His books, while not numerous, show a penetrating, well-informed mind, and an alert critical faculty. Most of them are stories and sketches of life in the Middle West, and include *The Real Issue, The Court of Boyville, Strategems and Spoils, In Our Town, A Certain Rich Man, God's Puppets, In the Heart of a Fool, The Martial Adventures of Henry and Me* and *The Old Order Changeth.* In 1946, after his death, his *Autobiography* was published.

WHITE ANT. See TERMITES.

WHITECAPS, in United States history, a name applied, because of the manner of their disguise, to a body of men who assumed the punishment of offenses against a community. In 1880 lawless bands in southern Indiana undertook to control that section.

At an earlier date a band calling themselves the Knights of the Golden Circle was active in the same district. Whitecaps adopted all methods, from warning and intimidation to actual violence. The Whitecaps were not able long to continue their activities. The chief reason for the rise of such organizations is the slowness with which the law is often administered and the injustice arising therefrom.

WHITEFIELD, *whit'feeld,* GEORGE (1714–1770), an English evangelist, founder of the Calvinistic Methodists, born at Gloucester, England. At the age of eighteen he entered, as servitor, Pembroke College, Oxford. There he met the Wesleys, and became active in their organization, called derisively the "Holy Club." After his ordination as deacon he followed the Wesleys to America, but soon returned to England to raise money for an orphanage in Georgia. Subsequently he made six trips to America, preaching in Georgia, Pennsylvania, and New England. He preached in England, Scotland and Wales, and is said to have delivered 18,000 sermons. His Calvinistic doctrines separated him from the Episcopal Church and ultimately from the Wesleys, and in 1743 he founded the Calvinistic Methodist Society, which, owing to its loose organization, disintegrated after the founder's death, which occurred at Newburyport, Mass. The members joined the followers of Wesley, from which nucleus grew the denomination known as Methodists. See WESLEY.

WHITE'FISH, a very important freshwater food fish of the salmon family, found in northern waters of both hemispheres. The common whitefish has an elongated body, with a hump back. The head is small and conical and the mouth toothless. Above, the color is bluish or olive, underneath, silvery. These fish live in deep water, feeding on mollusks, insects and larvae, but in the spawning season they migrate to shallow water in shoals. The common whitefish found in the Great Lakes is the most important freshwater fish in America. The yield of this fish for a single year in that country and Canada has been more than 30,000,000 pounds, valued at $1,500,000. So important is the industry that the United States Fish Commission has taken measures to promote the propagation of these fish.

WHITE HOUSE, called also the EXECUTIVE MANSION, the residence of the President of the United States, at Washington. It is on Pennsylvania Avenue, near several government administration buildings, and it is surrounded by a fine park. The first house on the site was occupied by President Adams in 1800. In 1814 the British army burned it, but restoration was begun next year under the direction of James Hoban, the original architect. Many changes and additions were made under various administrations. In 1949 the old building was found to be unsafe for occupancy, and President Truman and his family moved into Blair House while their official residence was extensively remodeled. The project was not completed until 1952.

Today the White House has 107 rooms. On the main floor are the State Dining Room, the Red Room, the Blue Room, the Green Room, and the East Room, which are used for official entertaining and are open to sightseers. Visitors, entering through the East Wing, may also see the lounges and reception rooms on the ground floor. The President's living quarters are on the second floor, and his working quarters are in the West Wing. A new basement was added to the White House in the remodeling of 1949-52.

WHITE LEAD, a heavy white powder consisting of seventy-five per cent white lead and twenty-five per cent hydrated lead oxide. It is used extensively in the manufacture of white paint, and is prepared by several processes, that most generally employed being what is called the Dutch, or stack, process. Coils of lead are placed in the upper part of an earthen pot containing acetic acid. These pots are stacked, covered with fermenting tan bark or manure, and allowed to remain so for two or three months, in the course of which time the metal is changed to a white powder, known as white lead. In the French process a boric salt of lead is prepared, and from it boric carbonate is precipitated by means of carbon dioxide. There are several other processes, some of them electric. White lead is valuable as a pigment, because it has body and purity of color. It dries quickly and does not crack. Its poisonous quality should not be lost sight of.

WHITE MOUNTAINS, a short range of the Appalachian system, situated in the north-central part of New Hampshire, extending approximately northeast and southwest. Because of their lofty summits these mountains are called the "top of New England."

The mountains rest upon a plateau about forty-five miles long, thirty miles wide and 1,600 feet above sea level. Upon this elevation some twenty peaks rise to varying heights. Some of these are separated from one another by narrow valleys, called notches. The mountains are clustered in two groups, of which the eastern is generally known as the White Mountains, and the western, as the Franconia Mountains. These groups are separated by a tableland, varying in width from ten to twenty miles. The principal peaks in the White Mountains are in the Presidential range, so named from the names of the peaks. Of these, Mount Washington, 6,293 feet, is the highest and is also the second highest in the Appalachian system. The other important peaks are Adams, Jefferson, Clay, Monroe, Madison and Boot Spur, all of which exceed 5,000 feet, while Franklin, Pleasant, Clinton and Webster have altitudes of 4,000 feet or more. In the Franconia group the most prominent peaks are Lafayette, 5,269 feet, and Moosilaukee, Liberty and Profile, all exceeding 4,000 feet. Intermingled with these prominent peaks in each group are numerous other lower mountains.

The White Mountains are traversed by the famous Crawford Notch, a narrow defile, lined with walls 2,000 feet high, through which the Saco River wends its way toward the sea. The other objects of special interest in this group of mountains are Tuckerman's Ravine, a deep gorge on the south side of Mount Washington, which is always partially filled with snow, and the summit of Mount Washington, which is reached both by carriage road and by railway, the first cog wheel railway in the world. On the summit are a hotel and a station of the United States Weather Bureau.

The principal object of interest in the Franconia Mountains is the Profile, or Old Man of the Mountains. This is a representation of the human face, formed by the projection of three rocks from the face of a nearly perpendicular cliff on the east of Cannon or Profile Mountain. One rock forms the forehead; the second, the nose and mouth, and the third, the chin. The profile is about 1,500 feet above the road from which it is seen, and it is ninety feet in length. It looks down upon a beautiful little lake known as the "Old man's wash bowl." It was an object of worship by the Indians for centuries before it was known to white men, and it is supposed to have given Hawthorne the inspiration which enabled him to write his beautiful allegory, *The Great Stone Face.* Near by is Echo Lake, a beautiful sheet of water, so enclosed by hills that an ordinary tone of the voice is repeated five times.

The summits of the White Mountains are bare and are composed of a variety of rock known as mica schist. The reflection of the sunlight upon this rock, when seen at a distance, gives the mountains the appearance of being covered with snow; hence the name, White Mountains or White Hills. For a century these mountains have been the great playground of New England. Their bases and sides are clothed with forests, among which are many winding roads and enticing walks. Clear, rushing streams and sparkling cascades surprise the traveler at many a turn in the path, and summits easily reached afford enchanting views.

WHITE PLAINS, Battle of. When Washington evacuated Long Island he moved his main force to White Plains, N. Y., on October 23, 1776. An outpost of 1,400 men was stationed on Chatterton Hill. On this outpost a British force of 4,000 made attack on October 28, routing the Americans, who withdrew to the main camp. This engagement is known as the Battle of White Plains.

WHITE RIVER, the principal tributary of the Wabash in Indiana. It is formed by the union of the East and West branches, which rise near the eastern boundary of the state and flow in a general westerly direction. The two streams unite near Petersburg, and the main stream then flows southwest for fifty miles and joins the Wabash just above Mount Carmel, Ill. On the West Fork are situated Indianapolis, the state capital, Noblesville, Anderson and Martinsville, the latter at the head of navigation. The East Fork is navigable to Rockford.

WHITE RIVER, a river of Arkansas, which rises in the northwestern part of the state, in the Ozark Mountains, where it is formed by several small streams, and flows northeastward into Missouri, returns into Arkansas and, after a general southeasterly and southerly course, enters the Mississippi fourteen miles above the mouth of the Arkansas. Its length is about 800 miles. Locks and dams make it navigable for river steamers about 480 miles. The large towns on its banks are Clarendon, Batesville and Newport.

WHITE SEA, a large arm of the Arctic Ocean, which penetrates Northern Russia to a distance of about 500 miles. The width ranges from thirty-five to 150 miles. It is broad at the northern entrance, but near its middle it narrows to a strait. Below this it spreads out in three large branches—Kandalak Bay, in the northwest, and Onega and Dwina bays, in the southeast. The chief rivers flowing into it are the Onega, the Dwina and the Mezen. Onega and Archangel are the principal ports. This sea is ice-bound from September to June, but it has a brisk summer trade, being connected by canals with the Baltic and with the Black and Caspian seas.

WHITLOCK, BRAND (1869–1934), an American diplomat, municipal reformer and writer. He was born at Urbana, Ohio, and was privately educated there. In his early years he had much experience as a newspaper reporter in Toledo, Ohio, and Chicago, Ill. He studied law, and in 1897 established a successful practice in Toledo. His books describing corruption in politics and injustice in business attracted much attention. In 1905 he was elected mayor of Toledo and three times thereafter, but declined a fifth nomination. In 1913 he was appointed by President Wilson United States minister to Belgium, and in that position gained the admiration of the world at the beginning of the World War through the tact, energy and efficiency shown in handling the difficult situation. In 1919 his post was raised to the rank of ambassador. His writings include *The Happy Average, Her Infinite Variety, The Fall Guy,* a volume of short stories, *On the Enforcement of Law in Cities, The Turn of the Balance, The Gold Brick, Abraham Lincoln,* a biography, *Forty Years of It,* an autobiography. In 1919 he published *Memories of Belgium, a Personal Narrative,* later issued in America under the title *Belgium.* His novels *Transplanted* and *Uprooted* are based on his observations in Europe. *LaFayette,* a biography, appeared in 1929.

WHITMAN, MARCUS (1802–1847), an American physician and missionary, born at Rushville, N. Y. He studied medicine at the Berkshire Medical Institution at Pittsfield, Mass., practiced four years in Canada, and in 1836 was sent by the American Board of Commissioners for Foreign Missions to explore the Oregon country and preach to the Indians. With his wife and two other missionaries he crossed the Rocky Mountains in 1836, taking the first wagon over the mountains. Other missionaries followed. Dissensions among them led the Board to withdraw its support; Whitman journeyed from the settlement, near the site of Walla Walla, to Boston, traveling much of the way on foot, and prevailed upon the Board to alter its decision. Whitman, his wife and twelve companions were murdered by Indians in 1847.

WHITMAN, WALT (1819–1892), an American poet, born at West Hills, Long Island, N. Y. He left the public schools of Brooklyn at the age of thirteen and applied himself to his father's trade, that of carpenter. Later he worked as a printer, school teacher and as general writer for the press. In these early years, as later, he sought with characteristic democracy the society of working men, and had many friends among them. During the Civil War he gave splendid service in the hospitals of Virginia and Washington, and permanently injured his health. At the close of the war he became a clerk in the Interior and Treasury departments at Washington, remaining until 1874, when a stroke of paralysis compelled him to resign.

In 1855 the first edition of his *Leaves of Grass* had been issued, and much of his later life was given up to the enlargement of this originally small volume. Whitman's avowed purpose was to be the prophet of democracy and of the common brotherhood of man. In his desire to free himself from all traditional trammels and to achieve naturalism, he often becomes tiresome. Though his work shocks many lovers of poetry by its lack of rhyme and rhythm, among discriminating critics it takes high rank, and it is becoming increasingly popular, not only among American readers, but also in Europe.

WHITNEY, ELI (1765–1825), an American inventor, famous as the originator of the cotton gin. He was born at Westborough, Mass., and was educated at Yale College. After graduation he went to Georgia as a teacher; later he took up the study of law. His leisure moments he often employed inventing useful devices, and, learning that the cotton industry was hampered by the difficult work of separating the cotton fiber from the seeds by hand, he set to work to invent a remedy. He labored under great disadvantage, for he had to make his own tools, but in time he produced a machine which would seed a thousand pounds in the same time that five could be seeded by hand.

At this juncture his workshop was broken into, and his apparatus was stolen before he could secure a patent. However, he and a man named Miller formed a partnership, and in 1793 they went to Connecticut to manufacture cotton gins; but the lawsuits in defense of Whitney's rights took all his profits, besides $50,000 voted him by the state of South Carolina. Finally, in 1798, Whitney turned his attention to the manufacture of firearms; he established a factory at Whitneyville, Conn., received large orders from the government and amassed a fortune. From his invention of the cotton gin, one of the most important of the whole series of inventions connected with the cotton industry, he reaped little financial reward. See COTTON GIN.

WHITNEY, GERTRUDE VANDERBILT (1878–1942), an American sculptress, the daughter of Cornelius Vanderbilt and the wife of Harry Payne Whitney, capitalist. Mrs. Whitney pursued her art studies in New York and Paris. Her most important sculptures include the *Aztec Fountain* in the Pan-American Building and the *Titanic Memorial,* both in Washington, D. C.; an equestrian statue in honor of "Buffalo Bill" Cody; the *El Dorado Fountain* in San Francisco; war memorials in New York, Arlington National Cemetery and Saint Nazaire, France. In 1931 she opened to the public the Whitney Art Museum, in New York, devoted to American art.

WHITNEY, JAMES PLINY, Sir (1843–1914), a Canadian statesman, born at Williamsburg, Ont., and educated at the Cornwall grammar school. He began the practice of law in 1876, and in 1890 was appointed queen's counsel. He was first elected to the legislature of Ontario in 1888, and was returned at each election up to and including that of 1908. In 1896 he was chosen leader of the opposition, and in 1905 was called upon to form a new government. In this he became the Prime Minister and assumed the office of Attorney-General. Later he relinquished the latter portfolio and became President of the Council. The honor of knighthood was conferred upon him by H. R. H. the Prince of Wales, in 1908, on the occasion of the celebration of the Quebec Tercentenary. He continued as Premier until his death.

WHITNEY, MOUNT, the highest peak in the United States proper, situated in the southern part of the California Sierra Nevadas. Its altitude is 14,495 feet, and its eastern slope rises steeply to a height of nearly 11,000 feet. Mount Whitney was named in honor of the noted geologist, Josiah Dwight Whitney.

WHIT'TIER, JOHN GREENLEAF (1807–1892), one of the foremost American poets. He was born near the town of Haverhill, Mass., Dec. 17, 1807. His parents were Quakers, who were always anxious to advance the interests of their children. The farm house was not far from the Merrimac River and near it was the brook whose "liquid lip" was companionship to them.

The young Whittier worked on his father's farm and learned the shoemaker's trade. He had little early education, except a few terms in the district school, and the wider training he received from his father and mother. Of books he had few and those not the best adapted to a child. The Bible, however, was thoroughly studied and its literary treasures fully appreciated. A volume of Burns fell into his hand and gave him the poetic inspiration. At the age of eighteen Whittier began writing for the press. One of his poems which appeared in the Newburyport *Free Press* attracted the attention of William Lloyd Garrison, its editor. Garrison visited the young poet at his home and induced him to give his pen and his life to the cause of freedom. This was the beginning of a life-long friendship. Garrison urged Whittier to obtain a better education, and assisted him in securing it.

Although Whittier had had comparatively little schooling, he had read widely and was well fitted to become, as he did, the chief poet of the abolition movement. In 1835 and 1836 he was a member of the legislature of Massachusetts, but ill health compelled him to resign and give up also the editorship of a paper which he was managing. In 1836 he moved to Amesbury, Mass. Later, Whittier went to Philadelphia; there he edited the *Pennsylvania Freeman,* anti-slavery paper. A mob burned the office after he had been at work on the journal barely four days. This did not compel Whittier, however, to give up the work, which he continued for two years. After his return to Amesbury, his poems on freedom continued to appear, and in 1843 a volume of ballads was published. Among his notable poems of these years, which appeared in *The National Era,* the *New England Magazine* and the *Atlantic Monthly,* were *Songs of Labor, Maud Muller* and *Barbara Frietchie. Snowbound,* published in 1865, brought great increase to Whittier's popularity and also an improvement in his worldly circumstances. He had no family, however, and most of his money was spent in charity. He died while on a visit to Hampton Falls, N. H.

Whittier's poems on slavery were too thoroughly inspired by the occasion for which they were written, too much given over to argument on this subject, to be permanently great poetry, but their energy and sincerity made them most effective aids toward the ends to which they were directed. Among his other poems, *The Barefoot Boy, Telling the Bees, Snowbound* and *Among the Hills* are most notable. They have a homely truth to life, a fineness of sentiment, a freshness and a quiet power which will make them live.

WHOOPING COUGH, *hoop'ing kof,* or pertussis, a contagious disease that frequently becomes epidemic. Half of those affected are less than 2 years old; adults rarely have it. It begins with the symptoms of a mild bronchitis. After a week or ten days the coughing is in paroxysms that end with a whoop, caused by a forcible indrawing of the breath. These paroxysms occur at rather short intervals, but between them the person feels reasonably well. After three to six weeks the attacks occur less frequently. Within two months they usually disappear entirely, although an ordinary cough persists for a few weeks longer. The disease is probably caused by a bacterium, the Bacillus Pertussis. It is sometimes fatal in infants because of complications, especially pneumonia. A child suspected of having whooping-cough should be kept from other children, for the disease is highly contagious. The patient should have nourishing food and live in the open air as much as possible. The sleeping room should be well ventilated, and whenever possible it is wise to sleep on a porch or in a tent.

WICHITA, *wich'i taw,* KAN., the county seat of Sedgwick County, 157 miles southwest of Topeka, at the junction of the Big and Little Arkansas rivers and on the Atchison, Topeka & Santa Fé, the Chicago, Rock Island & Pacific, the Saint Louis-San Francisco, the Missouri Pacific, the Midland Valley and the Arkansas Valley (electric) railroads. There are five airports and landing fields—one municipal field and one at each of the four aircraft factories in Wichita; three airlines serve the city.

Wichita is surrounded by a rich agricultural region with extensive trade in farm products. It is the largest broom-corn market in the world. Flour milling, livestock marketing, meat packing and oil refining are important industries. The four local airplane factories are widely known pioneers in aviation engineering. Important manufactures are aircraft, gasoline stoves and appliances, oil-field equipment, refrigerator cars, furnaces, building specialties and dairy products. Wichita is the center of the state's oil industry, and is one of the great wholesale centers of the Southwest.

The city is the seat of Friends University and the Municipal University of Wichita—the first municipal university in the state—and has also an art museum and a veterans hospital. Wichita was settled by Indian traders in 1869 and named after the Wichita tribe of Indians, who once roamed this region. It was chartered as a city in 1872, and since 1909 has been governed on the commission-manager plan. Population, about 168,000.

WICHITA FALLS, TEX., the county seat of Wichita County, 114 miles northwest of Fort Worth, on the Wichita River near its junction with the Red River, and on the Fort Worth & Denver City, the Missouri-Kansas-Texas, the Wichita Falls & Southern and the Wichita Valley railroads. There is regular service from the municipal airport.

Wichita Falls is an important trading center for a rich agricultural and oil-and gas-producing region. The principal industries are oil refining and the manufacturing of oil-well equipment and supplies, glass products, clothing and flour. A state hospital for the insane is located here. The city was founded in 1874 and incorporated in 1876. Its settlement and growth date from 1882, when the Fort Worth & Denver Railroad reached the place. It has a city manager form of government. Lake Kemp in the Wichita River supplies its water. Population, about 68,000.

WIDGEON, *wij'un,* a wild duck found in both Europe and America. The American widgeon, which is most abundant in the South, is often called the *bald pate,* from the white on the top of its head. It spends the winters in Central and South America and nests in Canada. The eggs, from seven to twelve in number, are buff-white. Widgeons are notorious for their trick of robbing canvasbacks and other diving ducks of the plant food picked from the beds of streams, by snatching it from their bills as they come out of the water.

WIESBADEN, *vees′bah den,* GERMANY, a celebrated watering place situated in the valley of the Salzbach, about two miles from the Rhine and six miles northwest of Mainz, in the American zone of occupied Germany. The town has a beautiful location among densely-wooded hills that protect it from cold winds. Mineral springs abound. It is purely a residence town, with no industries of importance. There are a number of churches of historic interest, a museum and a picture gallery. Population, about 221,000.

WIG′GIN, KATE DOUGLAS. See RIGGS, KATE DOUGLAS WIGGIN.

WIGHT, *wite,* ISLE OF. See ISLE OF WIGHT.

WIG′WAM, the conical tent of the American Indian. To make it he drives several saplings into the ground in a circle and fastens them together at the top. This framework he covers with grass matting or birch bark, leaving an opening at the top for the escape of smoke. A small opening in the side—always the side of the rising sun—serves as a door. This is ordinarily covered with a flapping deer-skin curtain.

WILBERFORCE, *wil′bur fohrs,* the name of two noted Englishmen, father and son.

William Wilberforce (1759–1833), statesman and philanthropist, was born at Hull, in Yorkshire, and educated at Saint John's College, Cambridge. In 1780 he was elected member of Parliament. In 1792 he succeeded in getting a bill for the gradual abolition of slavery through the House of Commons, only to have it defeated in the House of Lords. He continued to press the measure, and in 1807 it was passed. His efforts at last resulted in the passage in 1833 of the Emancipation Bill, abolishing slavery in the British colonies.

Samuel Wilberforce (1805–1873), the third son of William Wilberforce, was a clergyman, born at Clapham. He was graduated from Oriel College in 1826, and two years later was ordained. In 1845 he was appointed dean of Westminster, and the same year became bishop of Oxford, holding that post for twenty-four years; in 1869 he was made bishop of Winchester. He opposed the Oxford Movement (which see), at the culmination of which many of the High Church party went over to the Roman Catholic Church. Among his writings are *Agathos, Rocky Island* and *History of the Protestant Episcopal Church in America.*

WILBUR, two brothers prominent in American affairs.

Curtis Dwight Wilbur (1867–1954), lawyer and jurist, was born in Iowa. He graduated from the Naval Academy at Annapolis in 1888, but soon afterwards resigned from the navy to practice law in Los Angeles. In 1918 he was elected to the Supreme Court of California, in time becoming Chief Justice. He relinquished this position in 1924 when President Coolidge named him Secretary of the Navy. After he left the Cabinet in 1929, he became a United States Circuit Court Judge. He retired in 1945.

Ray Lyman Wilbur (1875–1949), an educator, was also born in Iowa. He graduated from Stanford University in 1897 and from Cooper Medical College in San Francisco in 1899. He was professor of Medicine at Stanford (1909–1916) and then president of the university (1916–1943). He took a leave of absence from the university to be Secretary of the Interior under President Hoover (1929–1933). From 1943 until his death he was chancellor of Stanford University.

WIL′COX, ELLA WHEELER (1855–1919), an American poet and essayist. She was born in Wisconsin and educated at the University of Wisconsin. From her girlhood she contributed freely to newspapers and magazines, and some of her writings acquired considerable popularity. Her volumes of verse include *Poems of Pleasure, Poems of Passion, Poems of Power* and *Maurine.*

WILD CAT, or **CAT′AMOUNT,** a wild animal belonging to the same family as the domestic cat, but of larger size than the latter. The European wild cat, once common but now seen only in the most isolated regions, has a very long body and legs and a short, thick tail. Its fur is yellowish-gray,

WILD CAT

with a dark marking down the back and other dark stripes on the sides and rings on the tail. In the United States the name is often applied to the lynx (which see).

WILDCAT BANKS, unstable banking institutions under loose state control, whose reckless issue of notes, followed by inability to redeem these securities, was responsible for a series of financial panics in the United States in the generation preceding the Civil War. The most disastrous of these panics was that of 1837. President Jackson had removed the government deposits from the United States Bank and placed them in state banks. At once, wildcat banks sprang up. Alarmed by the subsequent wild speculation, the President sought to correct the evil by ordering, through his famous "Specie Circular," that only gold and silver be received in payment for public lands. This precipitated a crash, and large numbers of wildcat banks failed. See Jackson, Andrew.

WILDE, Oscar Fingal O'Flahertie Wills (1856–1900), dramatist, essayist, and novelist, was born at Dublin, Ireland, the son of a noted surgeon. After graduation from Oxford, where he won honors in literature, he went to live in London and became leader of a so-called aesthetic movement. His affectation of long hair, velvet knee breeches and a languishing air furnished a theme for much witty satire. He was lampooned by Du Maurier in *Punch* and by Gilbert in his operetta *Patience.*

In 1881 Wilde published a volume of poems, and in 1888 a collection of fairy stories called *The Happy Prince and Other Tales.* These won high praise. Then appeared *The Picture of Dorian Gray,* a novel; *Intentions,* a volume of essays; and the plays *Lady Windermere's Fan, A Woman of No Importance, The Ideal Husband* and *The Importance of Being Earnest.* His drama *Salome* has been set to music by Richard Strauss. In 1895 Wilde was convicted of a serious offense against morality, and was condemned to two years' penal servitude. In prison he wrote the forceful *Ballad of Reading Goal,* and *De Profundis.* His last years were spent in seclusion on the Continent.

WILDER, Thornton Niven (1897–), an American author, born in Madison, Wis. He was educated at Oberlin, Yale, and Princeton, and in 1930 joined the faculty of the University of Chicago. Wilder's first novel, *The Cabala,* was published in 1925. His second, *The Bridge of San Luis Rey,* won the Pulitzer Prize in 1927. Two plays, *Our Town* (1938) and *The Skin of Our Teeth* (1942), also were awarded Pulitzer Prizes. Wilder published a successful novel, *The Ides of March,* in 1948.

WILDERNESS, Battle of the, the first important battle of Grant's famous Virginia campaign in 1864, between a force of 120,000 men under General Meade, supported by Warren, Sedgwick and Hancock, and with General Grant in supreme command, and the Army of Northern Virginia, under Lee, comprising about 62,000 men under Ewell, Hill and Longstreet. The Federals were encamped on the northern bank of the Rapidan, near Culpepper Court House. Grant began crossing the river on May 3, without opposition, Lee being confident that he could defeat the Federals when they had once become entangled in the Wilderness, a dense forest with thick underbrush. In the morning of May 5, General Warren was met by General Ewell, and an all-day battle resulted, with little advantage to either contestant. Grant at first believed that he was confronting only a part of Lee's army, but soon ordered Hancock to come up from Chancellorsville. Upon his arrival, he confronted General Hills, and another severe battle ensued. The engagement ended in a drawn battle: Grant had failed to make progress toward Richmond; Lee had failed to crush the opposing army. The losses of the Union forces were about 18,000; of the Confederates, from 10,000 to 12,000. See Civil War in America.

WILHELMINA, *vil hel me'nah* (1880–), queen of the Netherlands, born at The Hague. She succeeded to the throne in 1890, on the death of her father, William III, but the Queen Mother acted as regent until 1898. Wilhelmina was married in 1901 to Henry Frederick, Duke of Mecklenburg-Schwerin (died 1934). Her daughter, Juliana, heiress to the throne, was born in 1909, and in 1937 was married to the German Prince Bernhard of Lippe-Biesterfeld. When the Germans invaded Holland in 1940, the royal family escaped to London, where the queen maintained a government-in-exile throughout World War II; she returned to The Hague in 1945. In 1947 Wilhelmina turned over the reins of government to Princess Juliana, who became temporary regent, and in 1948 abdicated the throne.

WILKES, *wilks,* CHARLES (1798–1877), an American naval officer and explorer, born in New York City. He was educated in the common schools, entered the United States navy in 1818 and became a lieutenant in 1826. In 1838, in charge of an expedition authorized by Congress to explore the Southern Ocean, he visited many important places in the southern hemisphere, including the Philippine Islands, Hawaiian Islands, New Zealand, the Samoan and Fiji groups and many parts of South America. The mass of valuable scientific information collected on his voyages was published in several volumes. Wilkes was made a commander in 1843 and became a captain in 1855. Upon the outbreak of the Civil War he was given command of the frigate *San Jacinto.* On November 8, 1861, he overtook the English mail steamer *Trent* and arrested Mason and Slidell, the Confederate commissioners (see TRENT AFFAIR). He was retired in 1864, and became rear-admiral in 1866.

WILKES-BARRE, *wilks′bair re,* PA., the county seat of Luzerne County, 120 miles northwest of Philadelphia, on the north branch of the Susquehanna River, and on the Pennsylvania, the Lehigh Valley, the Central of New Jersey, the Delaware, Lackawanna & Western and the Delaware & Hudson railroads. There is regular air transport service. Thirty municipalities surround the city.

The city is in the heart of the anthracite region of the Wyoming Valley, the coal output of Luzerne County being greater in annual value than the entire gold production of the United States, exclusive of Alaska. Mining is the principal industry, but the abundance of fuel has made the city an important manufacturing center. The silk and lace mills are the oldest and among the largest in the United States, and there are besides manufactories of rayon, clothing, food products, metal products and tobacco products. Important manufactures are insulated copper wire, cutlery and airplanes and parts.

The Osterhaut Free Library has more than 40,000 volumes, and the Wyoming Historical and Geological Society has a reference library and a notable collection of Indian relics and geological specimens and fossils. Important structures are the Kirby Memorial Health Center, Fort Wilkes-Barre, built in 1776 as a protection against the Indians, and a monument marking the site of the Wyoming Valley Massacre (which see).

The city was first settled in 1769 by families from Connecticut. It was named in honor of John Wilkes and Isaac Barré, members of the British Parliament who advocated the cause of the colonists before and during the Revolution. In 1784, during the controversy between Pennsylvania and Connecticut over the sovereignty of the Wyoming Valley, the settlement was burned. The Wyoming Monument marks the site of the conflict of the Americans with the loyalists and Indians, July 3, 1778. Wilkes-Barre was made the county seat in 1786 and was incorporated as a borough in 1806. After the Civil War it grew rapidly and was chartered as a city in 1871. Population, about 77,000.

WILKIE, DAVID, Sir (1785–1841), a celebrated Scottish painter. He received his early art training at the Trustee's Academy, Edinburgh, and entered the schools of the Royal Academy, London, in 1805. His first works were scenes from everyday life, in which he showed the influence of the Dutch masters. In his later work, after his visits to Italy and Spain, he showed the influence of Titian and Velasquez and changed his theme to historical and portrait subjects. In 1811 he was made a member of the Royal Academy. Among his pictures are the *Blind Fiddler, Rent Day, The Village Festival, Penny Wedding, Cotter's Saturday Night, Duncan Gray, Blind Man's Buff, John Knox Preaching before the Lords of the Congregation* and *Wellington Writing a Dispatch.*

WILKINS, SIR GEORGE HUBERT (1888–), an English aviator, explorer and scientist, born in South Australia and a member of the Australian Flying Corps in World War I. Before the war (1913), he was photographer for the Stefansson Arctic expedition, and became interested in the cold regions of the world. In 1919 he was navigator on an airplane flight from England to Australia; in 1921 he joined the Shackleton Arctic expedition; in 1928 he flew from Alaska to Spitsbergen, and in the next year headed an expedition into Antarctica, where he explored hitherto unknown lands. Wilkins attempted a hazardous submarine trip under Arctic seas in 1931, but it failed when he was 400 miles from the North Pole, because of mishaps to his unseaworthy vessel. It was his most dangerous exploit. He was manager of Lincoln Ellsworth's expeditions of 1933-1939. In 1928 he was knighted by King George V.

WILL, that mental activity which gives a human being power of choice and action. Desire or feeling lies at the foundation of will, and the two are so interwoven that they cannot be separated.

J. B. Watson, the founder of behaviorism, once ventured the claim, "Give me a baby for three years and I will make any kind of a man of him you say." But so few babies receive perfect treatment that the psychologist finds many problems to solve. His professional counsel is often asked in guiding the growth of a young child's emotions and will, or in helping a painfully shy youth, or a law breaker, or a man who suffers a nervous breakdown, or a worker who cannot find the right job or perform his work safely, or a man and woman who will not live together happily as husband and wife. This wide field of service has attracted the psychologist, not because he is a jack of all trades but because most of the heartaches and failures in the world are due to the same cause: wrong mental and emotional adjustment—leading to a lack of will or to a will to do the wrong things.

This adjustment should properly take place in the first few years of life. Once this formative period has been past, it is hard to change a person's reactions to the world he lives in. It is, therefore, most important to know what the normal development of a baby is. During the first few years of life, the rate of growth of the brain and the amount of learning is much greater than it will ever be again. Even before birth, the nervous system controls the whole organism. A baby makes enormous advances both in controlling and in guiding his movements and in seeing the relationships in things and people around him. Recall that a new born baby has three instinctive emotions, love, fear, and anger; and that there are but a few certain causes which will produce any one of these emotions. A loud noise will make a baby shrink in fear. If every time he hears a loud noise, a rabbit is brought close to him, he will soon shrink from the rabbit even when there is no loud noise. His fear of rabbits was not inborn, as is his fear of noises. It has been acquired by association, or by what is called conditioning. This simple demonstration shows the way in which numerous fears, outbursts of temper and violent preferences that we find in older children and adults are built up. It shows also that many of the actions of a person are not deliberately willed, but are reactions to circumstances.

The baby begins early to respond to the behavior of those around him. If the people who care for him are kind and intelligent in their care, he in his turn will smile and love. If they are cross and awkward, he soon learns to cry and kick and to be wilful.

Graded scales of tests have been standardized so that the behavior and abilities of a child can be compared with those of other children of the same age. For instance, a four months baby will push his hand against a block and perhaps be able to pick it up, but a typical twelve months old child will nicely grasp the block between his thumb and first finger. Since each individual develops at his own rate, a slight difference from the typical performance means little. A child should not be forced ahead faster than his natural rate. But when a child is found to be backward, far behind other children of his age, he should receive special help. This training is important not only so that he can take care of himself in the future, but also to protect him from unfortunate situations in which he is made to feel inferior, or perhaps is punished for being lazy. It should be carefully done, however, so that the child does not develop into a dependent person without a will of his own.

Soon, when the child can get about for himself in his small world, he finds innumerable fascinating objects to explore and to learn about. But with this wonderful new world before him, he also finds himself chained down by don'ts. At this point he must be taught to respect the property and rights of others. But if he is merely restricted, he will become rebellious and resentful. He may not always show this outwardly. In fact he sometimes becomes the most docile and obedient of children only later to flare out in ungovernable temper or really malicious revolt. On the other hand, he may begin to feel very inferior, and this is almost as bad. It is said that 75 per cent of lying is traceable to this feeling of inferiority. Irritability is frequent among adults who have been brought up in an atmosphere of repression and parental tyranny. The will of the child should be respected and developed—not thwarted.

At the other extreme is the child who is always allowed to have his own way, never restrained, never punished. Although his parents may tolerate him, he soon finds that the outside world is a very different place where he cannot have his own way. The temper tantrums and crying which he found so convenient at home only react on himself. Some children brought up in such surroundings are never able to change, but grow up into men and women who are always getting into trouble. Such a person has never been taught that the wills of other people must be respected.

A child then should be brought up in surroundings as much as possible like those he will meet outside of his home. He should not be told arbitrarily not to do this or that, but be taught that other people have rights and that he cannot always do just as he pleases. When he comes to understand that his will is not supreme, he learns to fit very well into society.

When a child leaves home and starts to school he does not at once begin playing organized games. At about ten years he begins playing group games often competitive, and enters upon the "gang" age. He sometimes is the leader, sometimes follows. Although bad companions sometimes make this stage of development a dangerous one, the gang spirit when properly guided can be used to develop fair play and cooperation. This is really the best training ground for the will. The child meets his equals, and learns by trying to impose his will on others and by reacting against the imposition of their wills on him to develop a balanced character. In such situations the difficulties of superiority and inferiority are avoided. All these stages in a child's growth develop naturally at the proper time. They may be regarded as perfectly normal, not to be interfered with. Indeed, many times a child must be left alone—a lesson difficult for most parents and teachers.

If the child so far has been brought up sensibly and normally, he will find adolescence a happy and exciting experience.

Although the parent naturally wants his child to do as well as possible when he starts out to earn his own living, the parent should set tasks and goals which are within his capacity. In this way he becomes successful and happy, he gains confidence and poise and he retains the balance between dependence and independence which is typical of a properly developed will. Some of the most authoritative psychologists today say a nervous breakdown or social maladjustment is just prolonged childishness, the result of thwarted and under-developed will power.

WALTER VAN DYKE BINGHAM.

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WILL, in law, the legal declaration of a person's wishes as to the distribution of property after his death. It is an individually-made law, which, if its intent is clear beyond doubt and it does not conflict with public policy, no court can set aside. Technically, a *will* can dispose only of real property, the document relating to the disposal of personal property being called a *testament.*

In most states no will or testament is valid unless it is in writing and signed at the end by the maker, or *testator,* or by some person in his presence and by his direction. This signature must be made and the document acknowledged by the testator, in the presence of two or more witnesses, not beneficiaries by the will, present at the same time, and such witnesses must attest and sign the will in the presence of the testator. The will usually names one or more persons, known as executors, to direct the execution of its provisions. If none such is named, or if no will is made, the court appoints an administrator to the estate. In the latter case the property goes to lineal descendants of the deceased.

Any alteration in the will must be duly signed by the testator and the witnesses. An addition to the will is known as a *codicil.* A will may be revoked by canceling, obliterating, tearing or burning it; by a new will expressly revoking the former; or by one containing provisions inconsistent with it. The destruction of a later will revives a former will. At the death of the testator the will is recorded in the probate court, and that court directs the settlements. See EXECUTOR; PROBATE.

WILLAMETTE, *wil lah'met,* a river of Oregon, 250 miles in length, formed by the junction of the McKenzie and the Middle Fork. It rises in the Cascade Mountains, flows northward through a fertile valley and into the Columbia River. It is navigable to

Portland, fifteen miles from its mouth. A lock canal enables small craft to go around Willamette Falls and ascend 150 miles to Eugene.

WIL'LARD, Emma Hart (1787–1870), one of the pioneers in the cause of women's higher education in America, and founder of the Emma Willard School. She was born at Berlin, Conn. She taught a number of years, became principal of a girls' academy at Middlebury, Vt., and in 1809 married Dr. John Willard. In 1814 she wrote and submitted to New York state officials *A Plan for Improving Female Education,* with the result that she was able to establish at Waterford, N. Y. a girls' seminary partly supported by the state. This institution was removed to Troy and the name afterward changed to Emma Willard School. Under Mrs. Willard's management, it gained a wide reputation and is still one of the leading schools for the higher education of women. Mrs. Willard wrote a number of text-books, and was also the author of the famous poem *Rocked in the Cradle of the Deep.*

WILLARD, Frances Elizabeth (1839–1898), an American educator and reformer, born at Churchville, N. Y., and educated at Northwestern Female College, Evanston, Ill. She taught school for several years, traveled in Europe and the East and on her return became professor of æsthetics in Northwestern University and later its dean of women. She resigned in 1874, became secretary of the Woman's Christian Temperance Union and later its president, holding the latter office until her death.

FRANCES E. WILLARD

Miss Willard gave her entire time thereafter to the organization, traveling throughout the country from year to year, lecturing in prominent cities and writing extensively for the *Union Signal,* the organization's periodical, which she edited for six years. In 1883 she visited England and helped to form the World's Christian Temperance Union. Her former home, "Rest Cottage," in Evanston, is yet the headquarters of the national organization. In addition to articles in papers and periodicals, she was the author of *Nineteen Beautiful Years, Woman and Temperance, Glimpses of Fifty Years* and other books. See Woman's Christian Temperance Union.

WILLIAM I, surnamed The Conqueror (1027–1087), the first Norman king of England. He was the natural son of Robert II, Duke of Normandy, and as his father died without a legitimate heir, William became ruler and governed Normany with vigor and ability.

On the death of Edward the Confessor he claimed the crown of England as the nearest in line of succession. In 1066 he invaded England, overthrew Harold, the rival claimant, and then set about to subdue the people. The resistance of two powerful English nobles, Edwin and Morcar, who had formed an alliance with the kings of Scotland and Denmark and with the prince of North Wales, soon after drew William to the north, where he obliged Malcolm, king of Scotland, to swear allegiance. In 1069 an insurrection broke out in the north, and at the same time the English resumed arms in the eastern and southern counties, only, however, to be put down mercilessly.

William then established the administration of law and justice on a firm basis throughout England, conferred numerous grants of land on his own followers and introduced the feudal system of Normandy, in regard to land tenure and services. Toward the end of his reign he instituted that general survey of the landed property of the kingdom, the record of which still exists, under the title *Domesday Book.* Although the English had been completely subdued, William had to suppress several formidable revolts of his own vassals, and these he put down with an iron hand. Some of his measures were extremely severe, but they were in keeping with an age of brutality.

As a man William was not without a certain sense of equity and fair dealing, but was willing to sacrifice everything to make his kingdom stable. Viewed in the perspective of history, he is seen as one of the makers of modern England. See Hastings, Battle of; Domesday Book.

WILLIAM II (about 1056–1100), called Rufus ("the Red"), son of William the Conqueror, was crowned king at his father's death. The Norman barons were discontented with this arrangement and sought to make his elder brother, Robert, who had received Normandy, king of England, but this project was defeated by William, with the aid of the English nobles. Having repressed the conspiracy, he forced the Norman barons to withdraw to Normandy and confiscated their English estates. On the death of Lanfranc, he also seized the estates connected with the vacant bishoprics and abbeys. In 1090 he sent an army into Normandy, to punish his brother Robert, while he himself crossed the Channel the following year. A reconciliation was effected between the two brothers, and in 1096 Robert mortgaged Normandy to his brother, for a sum sufficient to enable him to join a crusade to the Holy Land. William was shot while hunting in the New Forest, whether accidentally or otherwise is not known.

WILLIAM III (1650–1702), king of England, Scotland and Ireland. He was born at The Hague, the posthumous son of William II of Orange and Mary, daughter of Charles I of England. During his early life, all power in the Netherlands was in the hands of the grand pensionary DeWitt, but when France and England in 1672 declared war against the Netherlands, there was a popular revolt, in which DeWitt and his brother were murdered and William was declared captain-general, grand admiral and stadtholder of the United Provinces. In 1678 William concluded with France an honorable treaty at Nimeguen.

Meanwhile, William had married Mary, the daughter of James II of England. As she was heir presumptive to the English throne he kept close watch upon the policy of James II, and in 1688 issued a declaration recapitulating the unconstitutional acts of the English king and promising to secure a free Parliament to the people. Being invited over to England by the leaders of the English parties, he arrived suddenly at Torbay in November, 1688, with an army. A great part of the nobility declared themselves in his favor. In December James fled with his family to France.

The throne was then declared vacant, the Declaration of Rights was passed, and early in 1689 William and Mary were crowned. Scotland soon afterwards accepted the new sovereigns, but in Ireland, whither Louis XIV sent James with an army, the majority of the Catholics maintained the cause of the deposed king, until they were defeated at the Boyne (1690). In the war with France William was less successful; but in spite of several defeats, he finally compelled Louis to acknowledge him king of England. In 1701 James II died and Louis XIV acknowledged his son as king of England. England, Holland and the Empire had already combined against Louis, and the War of the Spanish Succession was just on the point of beginning, when William died from the effects of a fall from his horse.

WILLIAM IV (1765–1837), king of Great Britain and Ireland, the third son of George III. He was educated for the navy, and although he had no real ability, he was promoted through successive ranks, until he became lord high admiral. In 1830 he succeeded his brother George IV on the throne. The great events which render his reign memorable are the passage of the Reform Act, the abolition of slavery in the colonies and the reform of the poor laws. William himself was mentally most unfit for ruling, but his ministers had matters almost entirely in their own control. He was succeeded by his niece, Victoria, whose reign was destined to be the longest and one of the most notable in English history.

WILLIAM I (1797–1888), king of Prussia and first emperor of Germany, crowned as such at Versailles in 1871. He was the son of Frederick William III of Prussia and Queen Louise. From his earliest years he received military training, and as early as 1814–'15 fought in the campaigns against Napoleon. He provoked the enmity of his people by his opposition to constitutional reform, to the extent of having to flee from the country at the beginning of the revolution of 1848. In 1849 he was in command of the army which crushed the uprisings in the Palatinate and Baden.

He became king of Prussia in 1861, and with the aid of his powerful minister, Bismarck, grew steadily in power. War against Denmark in 1864 was followed by war against Austria in 1866 and against France in 1870. The outcome of these conquests, in which William himself led the Prussian armies, was the consolidation of the German states into the empire whose aggressions forty years later involved the whole world in war (see GERMANY; WORLD WAR). It is an interesting fact that in 1919 German representatives signed a drastic peace treaty within one hundred feet of the spot where William I was crowned emperor. See VERSAILLES, TREATY OF.

WILLIAM II, in German, WILHELM II (1859–1941), the last king of Prussia and last German emperor before the founding of the republic in 1919. William II became emperor in 1888 at the age of twenty-nine, on the sudden death of his father, Frederick III, who had reigned only three months. A firm believer in the divine right of kings, as his grandfather, William I, had been, the young emperor early came into conflict with the strong-willed Chancellor, Prince Bismarck, forcing the latter's resignation in 1890, on March 18th.

WILLIAM II

Under the Kaiser, as he was commonly called, Germany became a great commercial and colonial power. Through his efforts the army was strengthened and the navy built to a strength second only to that of Great Britain. Although he was very popular with the people as a whole, he antagonized the Social Democrats by his hostility to electoral reform and his autocratic concept of kingship.

The outbreak of World War I in 1914 focused the attention of the world on the German emperor, who for many years was held solely responsible for the conflict. In 1918 came Germany's defeat, the abdication of the emperor and the founding of the republic. William retired to the Castle of Doorn in neutral Holland, which, in 1920, refused to surrender him to the Allied powers to be tried for war offenses. The empress died in 1921; in 1922 William married Princess Hermine of Schonaich-Carolath. See GERMANY; WORLD WAR I.

WILLIAM I, PRINCE OF ORANGE, COUNT OF NASSAU, called THE SILENT (1533–1584), founder of the Dutch Republic. He was brought up in the Catholic religion, although both his parents were Protestants. In 1544 he inherited from his cousin the Principality of Orange and large estates in the Netherlands. Under Charles V he served as commander of the army of the Netherlands and governor of Holland, Zealand and Utrecht. Philip II employed him in various offices, without, however, really trusting him.

When the Duke of Alva entered the Netherlands, William withdrew to Germany. His first open resistance to Spain was an invasion of Brabant in 1568. This was unsuccessful, and a second attempt in 1572 met with no better fate. Before this time, William had been chosen stadtholder by Holland, Utrecht, Zeeland, Gelderland and Overyssel, and in 1576 he succeeded in bringing about the "pacification of Ghent," whereby the southern provinces united with the northern, to expel the Spaniards and secure religious liberty.

The southern provinces shortly broke away from their allegiance to William, but in 1579, by the Union of Utrecht, the seven northern provinces, Holland, Zeeland, Gelderland, Friesland, Utrecht, Groningen and Overyssel, were formed into a league. Two years later the league formally deposed Philip and declared itself a republic with William as hereditary stadtholder. A price had been set by the king of Spain on William's head, and several unsuccessful attempts were made to assassinate him; a few years later he was shot at Delft.

WILLIAM AND MARY, COLLEGE OF, a coeducational liberal arts college at Williamsburg, Va., chartered in 1693 by King William and Queen Mary of England, after whom it was named. It is, next to Harvard, the oldest college in the United States. The Christopher Wren Building, the central hall of the college, is the oldest academic building still in use in America. It dates from 1693 and has been three times seriously damaged by fire; it has been restored by John D. Rockefeller, Jr. Among the graduates of William and Mary are Chief Justice John Marshall and three presidents—Jefferson, Monroe and Tyler. The college offers preprofessional programs of study. The student body, limited by physical capacity, is about 1,800, and the faculty numbers over 100. The library contains approximately 315,000 volumes and 400,000 manuscripts.

WILLIAMS, JOHN SHARP (1854–1932), an American statesman, born at Memphis, Tenn. He studied at the Kentucky Military Institute at Frankfort, the University of the South, the University of Virginia and the University of Heidelberg. He was admitted to the Tennessee bar in 1877, and in the following year removed to Yazoo City, Miss., where he practiced law and also became a planter. Taking an active part in Democratic politics, he was elected to Congress in 1893 and served continuously for sixteen years, becoming the leader of the Democratic party in the House. In 1911 he was elected United States Senator from Mississippi and was reëlected in 1917.

WILLIAMS, Roger (1604–1683), a Puritan divine, founder of the colony of Rhode Island. He was born of Welsh or Cornish parents. Williams attended the Charter House School and the University of Cambridge. In 1631, because of his Puritan beliefs, he emigrated to New England. There he became pastor of a church at Salem, but his extreme views regarding the jurisdiction of the civil magistrate caused him to be banished from the colony of Massachusetts, and he went with a few companions to Rhode Island and founded a settlement, which he called Providence.

There he established the first Baptist church in America. He was twice in England, in connection with a charter for the colony, and on these visits he made the acquaintance of Milton and other prominent Puritans. He published *A Key into the Language of the Indians of America, The Bloudy Tenent of Persecution for the Cause of Conscience, The Bloudy Tenent Yet More Bloudy* and *George Foxe Digged out of His Burrowes.*

WILLIAMSBURG, Va., the county seat of James City County, about fifty miles southeast of Richmond on a peninsula between the James and York rivers, and on the Chesapeake & Ohio Railroad. The town was established in 1632 on a central section of Middle Plantation, so called because of its location between the two rivers; it was palisaded and for many years used as a refuge from Indian attacks. Originally called Middle Plantation, it was renamed in honor of William III in 1699, when by legislative act it became the capital of the colony of Virginia in place of Jamestown (which see). It was the first city of the colony to be chartered (1722). From 1699 until 1779, when the capital was moved to Richmond, Williamsburg was the chief metropolis of the colony. The Battle of Williamsburg took place here in 1862. Part of the city is included in the Colonial National Historical Park.

The College of William and Mary (see William and Mary, College of), established in Williamsburg in 1693 in a building following Christopher Wren designs, is one of the chief features of the city. Here also is the country's oldest publicly supported institution for the insane, which opened in 1773. Bruton Parish Church, erected in 1678 and completed in 1717, is the oldest church in America to be continuously in use; it was restored in 1905–1907 by Rev. Dr. W. A. R. Goodwin, who became its pastor in 1902. A courthouse dating from 1769 and numerous other colonial buildings still stand. The first newspaper in the South, the *Virginia Gazette,* was founded in Williamsburg in 1736.

The idea of restoring pre-Revolutionary Williamsburg originated with Dr. Goodwin. The actual restoration, begun in 1928, was made possible by the donation of over $12,000,000 by John D. Rockefeller, Jr. The work is the result of thorough research and is authentic in every detail. More than 500 modern buildings on the site of colonial Williamsburg were torn down and about twenty were moved away. Nearly 300 colonial buildings have been restored or reconstructed, including the colonial capitol (destroyed by fire in 1832) and the Governor's Palace; the chief thoroughfare of the colonial capital, the Duke of Gloucester Street, has also been restored, so that Williamsburg has largely resumed its eighteenth-century appearance. Throughout the undertaking, its educational purpose has been emphasized.

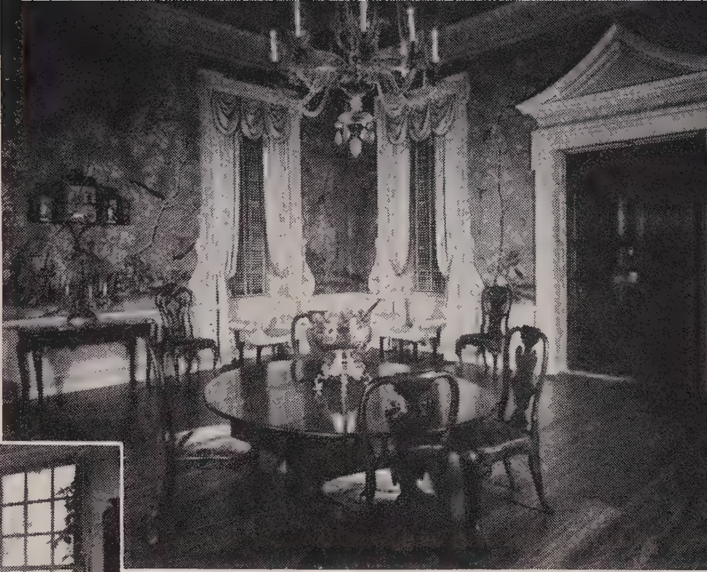
The nation's interest in the restoration of Williamsburg was reflected in an increased use of the colonial style of architecture in home building. Population, about 6,700.

WILLIAMS COLLEGE, a nonsectarian school for men at Williamstown, Mass., which developed from a free school established by Colonel Ephraim Williams. The funds donated by the colonel, who was killed in action in 1755, were invested and not used until 1793, when the school was chartered. The college has a faculty of over 100 members, an average enrollment of about 800 and a valuable library containing about 183,000 bound volumes, 40,000 pamphlets and 71,000 unbound government documents. The prosperity and high rank of the institution are largely due to the work and influence of Mark Hopkins, who was its president from 1836 to 1872. Among the well-known men who attended Williams are William Cullen Bryant, President Garfield and his son Harry A. Garfield; the latter was president of the college from 1908 to 1934, except during World War I, when he served as Fuel Administrator under President Wilson.

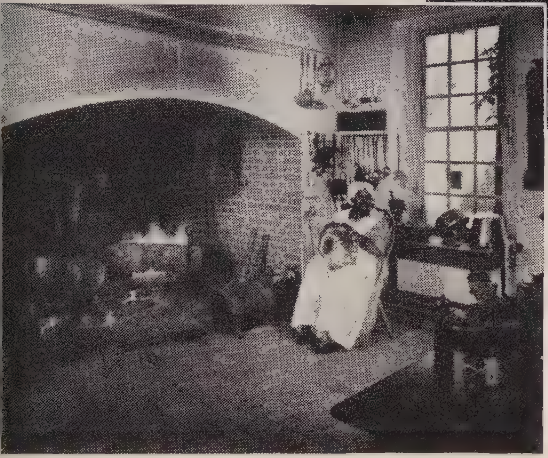
Williamstown is in Berkshire County, five

COLONIAL WILLIAMSBURG

CHIPPENDALE FURNITURE and antique Chinese wallpaper lend charm to the stately supper room of the Governor's Palace.

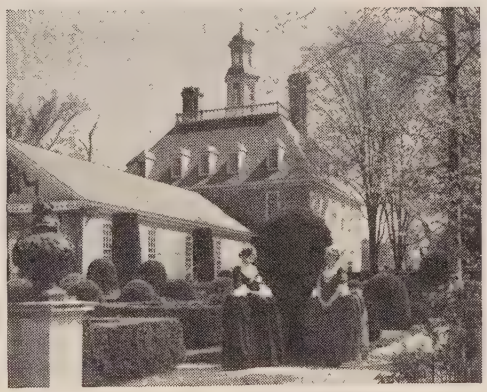


MEALS WERE COOKED on the open hearth of the kitchen house, carried to the main house, and warmed before they were put on the table.

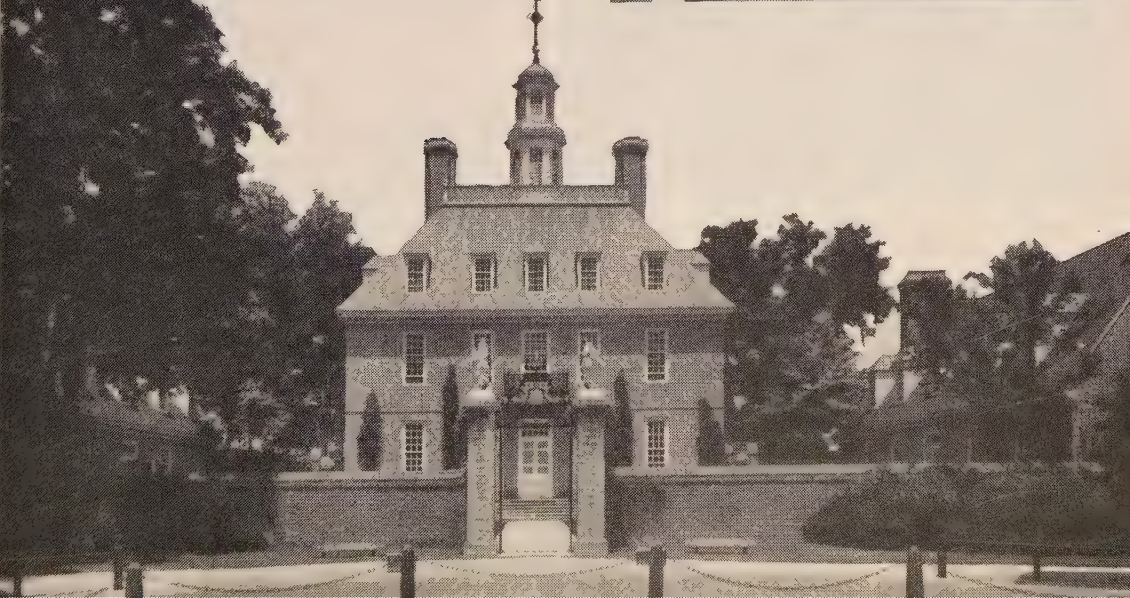


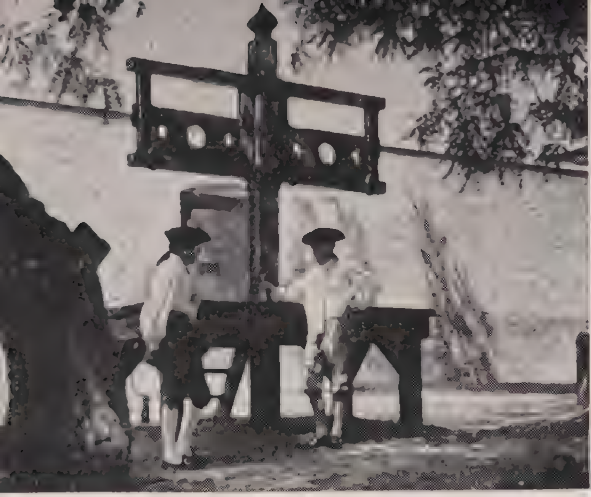
Colonial Williamsburg; Richard Garriso
Virginia Conservation Co

COLONIAL COSTUMES match the elegance of the ballroom wing of the eighteenth-century Palace and its formal boxwood gardens.



STURDY BRICK WALLS, pierced by a narrow gate, marked the easily defended entrance to the Governor's Palace.



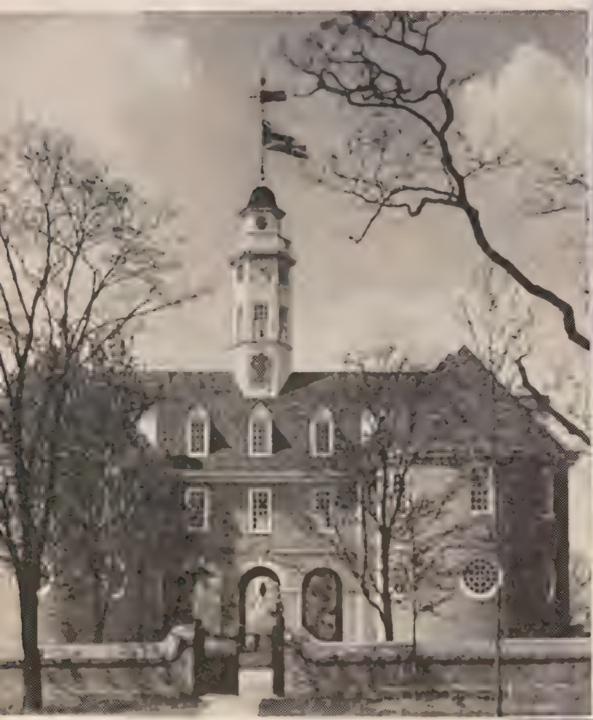


Colonial Williamsburg; Ferdinand S. Hirsh; Virginia Conservation Com.

HIS HEAD AND HANDS LOCKED IN THE PILLORY, a prisoner in old Williamsburg was the target for jeers and anything that could be thrown.

A WIGMAKER in colonial costume wears one of his own creations as he works.

THE ST. GEORGE TUCKER HOUSE is still occupied by descendants of the original owner, who came to Virginia from Bermuda.



THE CAPITOL AT WILLIAMSBURG is a reconstruction of the building which was begun on this site in 1699, when the government of Virginia moved to Williamsburg from Jamestown. It was destroyed by fire in 1747 and 1832.

VIRGINIA PATRIOTS PLOTTED REVOLUTION in the peaceful-looking old Raleigh Tavern. Burned in 1859, it was reconstructed in 1932.

miles west of North Adams. It had a population in 1940 of 4,294.

WILLIAMSPORT, PA., the county seat of Lycoming County, eighty-five miles north of Harrisburg on the West Branch of the Susquehanna River, and on the Pennsylvania, the Reading and the New York Central railroads. There is regular air service. Williamsport is on the Susquehanna Trail, midway between Washington, D. C., and Niagara Falls, N. Y. Once a lumbering town exclusively, the city now has over 100 diversified industries. The principal manufactures are aircraft engines and propellers, textiles, wire rope, sole leather, venetian blinds, paper and knit goods, steel and other metal products, and furniture.

Settlers established themselves here in 1779. The city was founded in 1795 by Michael Ross, and was granted a city charter in 1866. It is governed by a mayor and council. Population, about 45,000.

WILLINGDON, VISCOUNT (1866–1941), Governor-General of Canada, appointed in 1926 to succeed Lord Byng. Educated at Eton and Cambridge, he began his official life in Australia, and from 1905 to 1912 he was junior Lord of the British Treasury. In 1910, after ten years in the House of Commons, he was created First Baron of Ratton. In 1924 he was made Viscount Willingdon, and in 1935 a marquis. From 1931 to 1936 he held the post of Viceroy of India.

WILLIS, NATHANIEL PARKER (1806–1867), an American author, born at Portland, Me., educated at Andover and at Yale. After graduation he edited *The Legendary* and *The Token.* The *American Monthly Magazine,* from its establishment to its consolidation with the New York *Mirror,* was under his control. Willis traveled for some years as correspondent of the *Mirror* in Europe, Asia Minor, and England. His works include poetry, travel articles, and society sketches.

WILLKIE, WENDELL LEWIS (1892–1944), American lawyer and corporation executive, was born at Elwood, Ind., of German descent, his grandparents having emigrated from Germany to escape political persecution following the 1848 revolution. Both his parents were lawyers; his mother was the first woman admitted to the Indiana bar.

He was one of a family of six children and was reared in a free atmosphere of give and take that left its mark upon his whole life. His vigor and spontaneity were remarkable and were equally in evidence whether his activities were condoned or condemned —always he retained the courage of his convictions.

He went through college, taught school, studied law, became a utilities director, and a banker. Several years as counsel for the Firestone Tire and Rubber Company in Akron, Ohio, preceded his services as co-counsel for the Commonwealth and Southern Electric Utilities Company, in New York. After four years in that capacity, he was appointed president of the corporation in 1933. His brilliant management placed the firm on a paying basis and in 1939 the holdings were sold to the government on an equitable basis.

Willkie in politics was unprecedented. He had never run for or held any public office until he was catapulted into the Republican presidential race in 1940. Moreover, he was not a regular Republican, was unknown in the various party organizations, and was vigorously opposed by the few regulars who had known him. His nomination was wholly unorthodox as was his campaign, both unfettered by machine politics and more or less cyclonic in effect; no defeated candidate ever polled such a popular vote—22,327,226, more than 44 per cent of the ballots cast.

Willkie in defeat was again unorthodox—he accepted the country's verdict with good grace and emerged as a most admired and respected leader of the opposition, although increasingly maligned by many former supporters. His qualified support of Roosevelt's policies was based upon constructive criticism.

He went as a personal observer to England in 1941 preceding lend-lease legislation. Again, as a sort of presidential envoy, he conferred with various Allied leaders, including the Russian and Chinese, in 1942. In *One World,* which he wrote upon his return, he presented a vigorous thesis for world co-operation. He put up a valiant fight for progressivism within his party, but with the Wisconsin primaries found that his candidacy was impossible in 1944. He formally dropped his bid for renomination but continued his fearless criticism of both party platforms until his death.

WILLOW, *wil'o,* a group of trees and shrubs common in the cold and temperate regions of the Northern Hemisphere, with a few representatives in Australia and some of the islands of the Southern Pacific. All thrive in moist ground, and are most common on the banks of streams and ponds and in marshes. The alternate leaves are long, slender and pinnate; these are preceded by flowers in the form of catkins. The catkins, which are clothed with long, glossy hairs, are popularly known as *pussy-willows*. On account of the flexible nature of the shoots of many species and the toughness of their wood and fibers, they have always been used as materials for weaving baskets, hoops and crates. Baseball bats, hoe handles and many similar articles are made from the wood of the white willow, and wooden shoes, pegs and other small objects are constructed from other species. The *weeping willow,* which is a native of China, is a fine ornamental tree that is often planted in parks.

WILMINGTON, Del., the largest city in the state and the county seat of New Castle County, is twenty-seven miles southwest of Philadelphia, on the Delaware River at its junction with the Christina and the Brandywine rivers, and on the Baltimore & Ohio, the Reading and the Pennsylvania railways. Several airports are in the vicinity. Wilmington, containing almost half the population of Delaware, is the largest city and chief seaport and manufacturing center of the state. There are about 200 industries; of these the leading are the manufacturing of leather, cotton bleaching and dyeing, hard-fiber vulcanizing, shipbuilding and machinery manufacturing. The city is the headquarters for immense chemical and paper factories. A marine terminal on the Delaware River accommodates coastwise and ocean traffic; a sea-level canal connects Delaware and Chesapeake bays.

Eleuthère Irénée du Pont de Nemours in 1802 began the manufacture of powder on the Brandywine near Wilmington. His factory has become the largest chemical factory in the country. See Du Pont.

An interdenominational theological seminary is located in Wilmington; the state university is fourteen miles distant, at Newark. Holy Trinity Church, built by the Swedes in 1698 and popularly called Old Swedes Church, is one of the oldest churches in continuous use in the nation. Charitable institutions include an industrial school for girls, a home for friendless children, a home for orphan colored boys, two homes for the aged, the Florence Crittenton Home for unfortunate girls and the state hospital for the insane. One of the points of interest is Old Swede Rock, where the first white settlers landed. These colonists formed the first permanent settlement of the state.

Wilmington was first settled by the Swedes under Peter Minuit in 1638. It was taken by the Dutch in 1655, and they in turn were succeeded by the English in 1664. It fell into decline until Thomas Willing laid out the streets in 1731. William Penn landed at a near-by point in 1682. The original First Presbyterian church was erected in 1741. General George Washington occupied headquarters in the city during the battle of the Brandywine. The charter for the borough was issued by William Penn in 1739. The city charter dates from 1832. The first iron steamship constructed in the United States was built here in 1836. The founder of the du Pont de Nemours family, manufacturers of powder, died near Wilmington in 1817. Population, about 110,000.

WILMINGTON, N. C., the county seat of New Hanover County, 148 miles southeast of Raleigh, on the Cape Fear River about thirty miles from its mouth, and on the Seaboard Airline and the Atlantic Coast Line railroads, both of which maintain railroad shops here. The Bleuthenthal airport is near the city. Wilmington is the state's major deep-water port and is the center of a productive agricultural and trading area. The principal industries are fertilizer and lumber manufacturing, wood creosoting, the extracting of bromine from ocean water, petroleum product distributing and shipbuilding. Wilmington has a house of correction and a home for aged women. Camp Davis is thirty miles north, at Holly Ridge.

The city was founded by the English in 1730 as New Liverpool, receiving its present name in 1739. The Stamp Act resistance here in 1765 antedated the Boston Tea Party by eight years. Wilmington was Cornwallis' headquarters in the Revolutionary War (1781). In the Civil War the Confederates kept the port open until Fort Fisher fell on January 15, 1865. The city was incorporated in 1866; it has the commission form of government. Population, about 45,000.

WIL′MOT PROVISO, *pro vi′ zo,* an amendment presented in Congress in 1846 to a bill providing for the purchase of territory from Mexico. It was offered by David Wilmot, a Democrat from Pennsylvania, and provided that "neither slavery nor involuntary servitude shall ever exist in any part of such territory, except for crime whereof the party shall first be duly convicted." The amendment was adopted in the House, but did not come to a vote in the Senate, and in the next Congress the bill was finally passed without the amendment.

The debate in Congress over the question resulted in a breach between Northern and Southern Democrats, which led to the adoption by that party of the doctrine of popular sovereignty. This in turn resulted in the withdrawal of many Northerners, who joined the Free-Soilers and later became prominent in the Republican party.

David Wilmot (1814–1868), an American politician and jurist, born at Bethany, Pa. He was admitted to the bar in 1834 and began his practice at Towanda. He became a prominent Democrat and served in the House of Representatives from 1845 to 1851. There he opposed the extension of slavery into the territory acquired from Mexico and was the sponsor for the famous Wilmot Proviso. He later joined the Republican party, was an unsuccessful candidate for governor of Pennsylvania in 1857, served in the Senate for two years (1861–1863), and thereafter was judge of the United States court of claims.

WILSON, Augusta Evans (1835–1909), an American novelist, born at Columbus, Ga. In 1868 she married a Mr. Wilson and afterwards lived at Mobile, Ala. Her books are sentimental, but harmless, and make a wide appeal. They have retained a greater popularity over a longer period than the collected works of any other American novelist. The titles are *Inez, A Tale of the Alamo, Beulah, Macaria, Saint Elmo, Vashti, Infelice* and *At the Mercy of Tiberius.*

WILSON, Henry (1812–1875), an American statesman, born in Farmington, N. H. His original name was Jeremiah Jones Colbraith, but he abandoned the name upon reaching manhood. He was first employed on a farm, later he learned the shoemaking trade, earned money to pay for an academic education and finally engaged in the manufacture of shoes at Natick, Mass. In 1840, as the "Natick cobbler," he addressed political meetings, winning wide fame, and in that year he was elected to the Massachusetts legislature. In 1848 he began to edit the Boston *Recorder,* as a Free-Soil organ. In 1855 he was chosen United States Senator, as a Free-Soiler or Know-Nothing, to succeed Edward Everett. His speeches against slavery are among the most important of the period. He served for a short time on the staff of General McClellan in the Civil War. In 1872 he was elected Vice-President, on the ticket with President Grant, but died before completing his term.

WILSON, James (1742–1798), a native of Scotland, an emigrant to the American colonies in 1766, an eminent patriot and a signer of the Declaration of Independence. He became a member of the Colonial and Continental congresses, and also of the Constitutional Convention of 1787. His speech in the Pennsylvania convention later secured the ratification of the Constitution by that state.

WILSON, James (1835–1920), an American statesman and administrator. He was born at Ayrshire, Scotland, and emigrated to America at the age of seventeen. He attended Iowa College, engaged in farming and later entered the state legislature, of which he became speaker. From 1873 to 1877, and from 1883 to 1885, he was a member of Congress. At different times he was regent of the University of Iowa, director of the Agricultural Experiment Station and Professor of Agriculture at the Iowa Agricultural College. In 1897 he became Secretary of Agriculture, remaining in that post sixteen years, a longer term than any other cabinet member has ever served.

WILSON, John (1785–1854), a Scottish poet and essayist, better known as "Christopher North." He was born at Paisley, Scotland, educated at Glasgow University and at Oxford and on leaving college settled on an estate on Lake Windermere, where he gave himself up to literary work. Wordsworth, Southey and Coleridge were among his acquaintances. His first independent publication was a poem called *The Isle of Palms,* and this was followed by *The City of the Plague,* a second book of poems. When *Blackwood's Magazine* was established, in 1817, Wilson became one of its contributors, and for many years he wrote some of the most notable articles in that periodical. In 1820 he was appointed to the chair of moral philosophy in Edinburgh University, a position which he held for thirty-one years.

Most famous, perhaps, of the writings of Wilson are the *Noctes Ambrosianae,* which abound in graceful humor and sentiment. Among his other works are three novels, *The Lights and Shadows of Scottish Life, The Trials of Margaret Lyndsay* and *The Foresters.*

Woodrow Wilson

WILSON, [THOMAS] WOODROW (1856–1924), an American educator, writer and statesman, the twenty-eighth President of the United States, and the first Democrat after Andrew Jackson to serve two consecutive terms. His administrations are linked with stupendous changes in domestic and international history. He was a man of deep sympathy for the workers of all nations, and during his lifetime his writings were probably read and quoted more widely than those of any other public leader. In politics he was a liberal, and he sponsored much progressive legislation.

Early Life. Both of the grandfathers of Woodrow Wilson were born in the British Isles. Joseph Ruggles Wilson, the father of the future President, was a well-known educator and a distinguished clergyman of the Presbyterian Church, South. While Dr. Wilson was preaching in Staunton, Va., his third child and first son, Thomas Woodrow, was born, on December 28, 1856. The boy was taught at home until his ninth year, and in 1873, when a lad of seventeen, he entered Davidson College, N. C. Before the end of the first year he left school because of ill health, and when he again entered college, in 1875, he registered at Princeton.

Woodrow Wilson was graduated with the class of 1879, entered the law school of the University of Virginia, where he remained a year, and in 1882 began the practice of law in Atlanta, Ga. Within the course of a year he abandoned his practice to become a postgraduate student at Johns Hopkins University. Here he specialized in government and jurisprudence.

Career as Educator. In 1885 Wilson received his doctor's degree, having submitted as his thesis a book that is now a standard classic in its field—*Congressional Government: A Study in American Politics.* For a quarter of a century after leaving Johns Hopkins he rose steadily to distinction as an educator. From 1885 to 1888 he was associate professor of history and political economy at Bryn Mawr College, and from 1888 to 1890 held a similar position at Wesleyan University, Middletown, Conn.

Wilson was offered the professorship of jurisprudence and political economy at Princeton in 1890, and in that year began an association with his alma mater that was to last twenty years. In 1902 he succeeded Dr. Francis L. Patton as president. Among the several reforms inaugurated by Wilson as head of the university, the most radical was the introduction of the preceptorial system. On the whole, his record was sufficiently brilliant to make him a prospective nominee for governor in 1910.

In Politics. New Jersey was a Republican state, and the president of Princeton was a Democrat, but when the Democratic convention nominated Wilson, the liberal elements of all parties could approve the choice. The Democratic candidate presented a progressive platform and was elected by a plurality of 49,056.

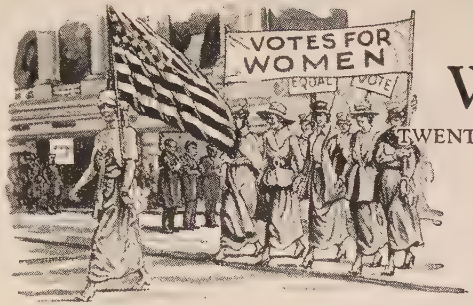
As governor he showed exceptional qualities of leadership. When he met with "machine" opposition he did not hesitate to appeal to the people over the heads of the politicians. In the Democratic national convention of 1912, which met at Baltimore, Md., he was nominated after a somewhat protracted contest. His chief opponent, Champ Clark of Missouri, had the backing of the conservative elements, but the fight for Wilson's nomination was led by William Jennings Bryan, and his nomination was accepted with hearty approval by the rank and file of the party. Wilson's opponents were President Taft and Theodore Roosevelt. With Thomas R. Marshall of Indiana as his running mate, he carried forty states and received 435 electoral votes. A Democratic Congress was also elected by an overwhelming majority.

First Term. The Sixty-third Congress was called in special session on April 7, 1913, primarily for the purpose of framing a new tariff law. President Wilson excited much comment by appearing personally before the assembly and reading his message himself, a practice which had been abandoned after the administration of John Adams. The bill, which, after weeks of debate, was signed on October 3 by the President, brought about a general reduction of duties on a long list of commodities.

Meanwhile, preliminary work was being done on the revision of the banking laws, and the Federal Reserve Act received the President's signature in December,

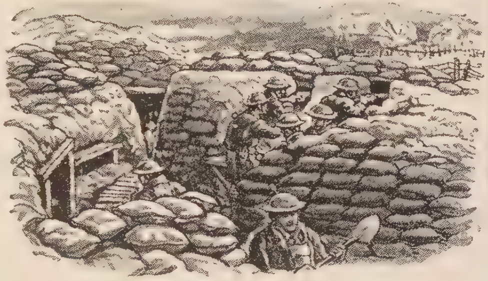
THE ADMINISTRATION OF
WOODROW WILSON

TWENTY-EIGHTH PRESIDENT OF THE UNITED STATES—1913 *to* 1921



THE NINETEENTH AMENDMENT LEGALIZED NATIONAL WOMAN SUFFRAGE

A REVOLT IN MEXICO AND VILLA'S RAIDS DISTURBED RELATIONS BETWEEN THE TWO COUNTRIES



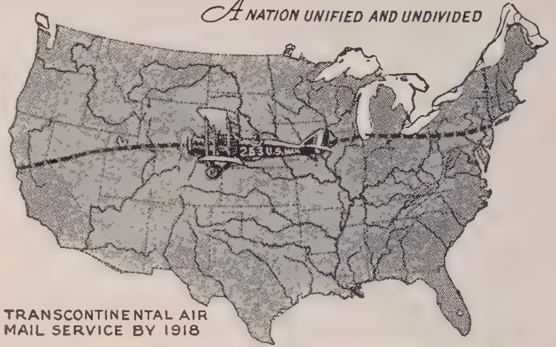
WORLD WAR I CONQUERED GERMAN MIGHT

Woodrow Wilson inaugurated the third major era of American democracy, and became the spokesman for world idealism. Three amendments to the Constitution were marks of progress. The levying of Federal income taxes became a permanent policy of the Government. The Federal Reserve System was established and legislation was enacted to curb trusts and prevent unfair trade practices. The President adopted a policy of "watchful waiting" in regard to Mexico's revolt. Germany's defiance of neutral rights helped to draw the United States into World War I. Accustomed to peace, the nation turned quickly to arms. War drew out the noblest and the basest. Along with sincere patriotism there was selfish profiteering. Capital and labor were in conflict.

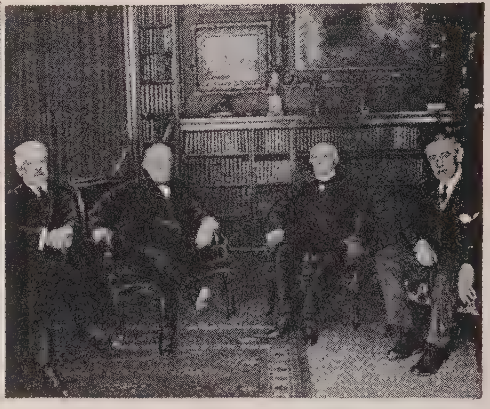
German militarism was defeated, but the causes of war remained. With the millennium of a warless world unrealized, the people turned their thoughts toward "normalcy" and national prosperity.

POPULATION, 1920, 105,710,620.

A NATION UNIFIED AND UNDIVIDED



TRANSCONTINENTAL AIR MAIL SERVICE BY 1918



ORLANDO - LLOYD GEORGE - CLEMENCEAU - WILSON
THE "BIG FOUR" OF WORLD WAR I

After the midwinter recess Congress reassembled on January 20, 1914, and heard the President's message on anti-trust legislation. Two important laws followed—the Clayton Anti-Trust and the Trade Commission acts.

Complications with Mexico arose during President Wilson's administration, culminating in an expedition under General Pershing. War in Europe began in August, 1914.

The Campaign of 1916. In the summer of 1916 President Wilson and Vice-President Marshall were unanimously nominated to succeed themselves by the Democratic convention which met at Saint Louis. The Republicans nominated Charles Evans Hughes and Charles W. Fairbanks. The campaign lacked the dramatic elements of the campaign of 1912. The contest was close. Though Wilson increased his popular vote over that of 1912 by nearly 3,000,000, he won by an electoral vote of 277, only twenty-three more than Hughes received.

The Nation at War. In every way possible, President Wilson had tried to preserve neutrality. All hopes for peace were abandoned, however, when the German government announced, late in January, that unrestricted submarine warfare would be started on February 1.

Unhesitatingly the President broke off relations with Germany, and on April 6, 1917, signed the Congressional resolution that made the United States an associate with the Allies in the war. (Details will be found under the headings UNITED STATES and WORLD WAR.)

America and World Peace. The President announced that he would head the American delegation to the peace conference, and in December, 1918, he sailed for Europe.

With the exception of a brief interval late in February, when he returned home to sign bills passed by Congress, the President remained in Europe until the last of June. On his first trip he visited Italy and England, receiving there and in France extraordinary ovations from the people. He took a conspicuous part in the Paris discussions leading up to the treaty with Germany, signed it on June 28 in the Palace of Versailles, and reached home early in July, 1919.

During the President's absence formidable opposition in the Senate had developed to the provisions of the League of Nations. The Senate refused to ratify the treaty and the League Covenant. Wilson's health gave way under the strain, and when he gave up office in 1921 he was a sick man. He continued to reside in Washington as a private citizen, and exerted his influence constantly in the cause of international peace. In 1920 he had been awarded the Nobel Peace Prize. Wilson died in Washington on February 3, 1924. He was buried in the Cathedral of Saints Peter and Paul.

Other Events. Two amendments to the Constitution became effective, the XVIIth (1913), providing for the direct election of Senators, and the XVIIIth, making illegal the sale and manufacture of alcoholic liquor. The XIXth amendment, enfranchising women, was adopted by Congress in 1919. On July 1, 1919, the United States became temporarily a "dry" nation, in accordance with a war food-conservation measure.

The government took control of the railroads, the telephone and telegraph systems and the cables, and operated them for varying intervals. Another innovation was the establishment of daylight saving by having all clocks moved forward one hour on the last Saturday in March and moved back in October. The plan was in force one year.

Except for a few months after the outbreak of World War I, the United States enjoyed great prosperity during the Wilson administration. However, President Wilson was confronted by larger and more varied problems during his two terms than any other President since Lincoln.

The White House Family. President Wilson was twice married. He and his first wife, Ellen Louise Axsen, of Savannah, Ga., were married in June, 1885. She died on August 6, 1914. The second Mrs. Wilson, who had been Mrs. Edith Bolling Galt, became mistress of the White House on December 18, 1915. The three daughters of President Wilson created much quiet interest among Americans. The eldest, Margaret, was a singer of note, and active in social welfare work. Jessie and Eleanor Wilson were both White House brides, the former marrying Francis B. Sayre, and the latter William G. McAdoo, former Secretary of the Treasury.

Woodrow Wilson, Author. For distinction of scholarship and charm of style Wilson's writings have a high place. His *Congressional Government* has been mentioned. At Wesleyan he wrote *The State*. In 1893

Administration of Woodrow Wilson, 1913-1921

- I. THE PRESIDENT
  - (1) Ancestry
  - (2) Birth
  - (3) Education
  - (4) Career as educator
  - (5) Governor and President
  - (6) Character
  - (7) Writings
- II. GOVERNMENT AFFAIRS
  - (1) Domestic
    - (a) Underwood Tariff Law
      - (1) Revised tariff downward
      - (2) Income tax provisions
    - (b) Federal Reserve Act
      - (1) Twelve Federal Reserve banks created
      - (2) Stabilized financial conditions
    - (c) Clayton Anti-Trust Act
    - (d) Trade Commission Act
    - (e) Repeal of Panama Tolls clause
    - (f) Seventeenth Amendment
      - (1) Direct election of Senators
      - (2) In force, 1913
    - (g) Eighteenth Amendment
      - (1) Prohibition of liquor manufacture and sale
      - (2) Effective January 16, 1920
    - (h) Nineteenth Amendment
      - (1) Women enfranchised
      - (2) Adopted by Congress in 1919
    - (i) Daylight saving adopted
  - (2) Foreign
    - (a) Mexico problem
      - (1) Refusal to recognize Huerta
      - (2) Tampico episode
        - (a) Occupation of Vera Cruz
        - (b) "ABC" mediators
      - (3) Villa raid on Columbus, N. M.
        - (a) Invasion by Pershing's troops
        - (b) Withdrawal of troops
    - (b) World War
      - (1) Neutrality maintained until 1917
      - (2) German aggressions against America
      - (3) Diplomacy of President
      - (4) Reëlection of Wilson in 1916
    - (c) United States enters the war, April 6, 1917
      - (1) Conscription
      - (2) Army in France
      - (3) Liberty Loans successfully floated
      - (4) Government operation of railroads
      - (5) Armistice, November 11, 1918
    - (d) Peace Negotiations
      - (1) President goes to Paris
      - (2) Treaty presented to Senate
      - (3) Controversy over league of nations
- III. MISCELLANEOUS EVENTS
  - (1) Completion of Panama Canal
  - (2) Panama-Pacific Exposition
  - (3) "War-time" prohibition effective July 1, 1919
  - (4) Death of Theodore Roosevelt

Questions on Woodrow Wilson

Who were Woodrow Wilson's grandfathers?

Sketch his career as educator.

Why did he not continue the practice of law?

What was there unusual about his election as governor of New Jersey?

What precedents did Wilson ignore while President?

What amendments were proposed or became effective in his administrations?

In what ways was the Wilson era a period of change?

How long did he remain in Europe?

he published *Division and Reunion,* an account of American history from 1829 to 1889; the same year he brought out *An Old Master and Other Political Essays* and *Mere Literature and Other Essays.* His *History of the American People,* in five volumes, was published in 1902. Of later date were *The New Freedom, Guarantees of Peace* and *International Ideals.*

Bibliography. Ray Stannard Baker's *Woodrow Wilson, Life and Letters* (8 vols., 1927-1939), is the authorized biography. Sidelights on Wilson's career as President will be found in *The Intimate Papers of Colonel House* (4 vols.), covering the period 1912-1919. *Woodrow Wilson and His Work,* by William E. Dodd, is written from the standpoint of a friend; among others in personal touch with Wilson who contributed lives are Joseph P. Tumulty, Josephus Daniels and David F. Houston. R. S. Baker and W. E. Dodd edited his state papers and messages.

Related Articles. Consult the following titles for additional information:

Banks and Banking
Lusitania
Mexico (history)
Nations, League of
Prohibition
Tariff
Woman Suffrage
World War

WILSON, William Lyne (1843-1900), an American statesman and educator, born in Jefferson County, Va. He was graduated from Columbian College, Washington, D. C., studied at the University of Virginia and served in the Confederate army. Later he became professor of Latin at Columbian College and practiced law from 1871 to 1882, when he was chosen president of the University of West Virginia. In 1883 he entered Congress as a Democrat and served twelve years. As chairman of the Ways and Means Committee, he led the opposition to the Sherman silver purchase law and was the author of the famous Wilson Tariff Bill (see Tariff). In 1895 he was made Postmaster-General by President Cleveland, and at the close of his term became president of Washington and Lee University.

WINCHELL, Alexander (1824–1891), one of America's greatest geologists, who produced more than twenty volumes on geological topics and who taught for many years. He was born in Dutchess County, N. Y., and was graduated in Wesleyan University in 1847. Immediately he was appointed to the chair of physics and civil engineering at the University of Michigan, but was soon transferred to the geological department. He was a founder of the Geological Society.

WIND, movements of the atmosphere caused by unequal heating and the resultant inequality of pressure on different parts of earth's surface. The temperature is highest and the atmospheric pressure is lightest at the equator, while at the poles the temperature is lowest and the air most dense.

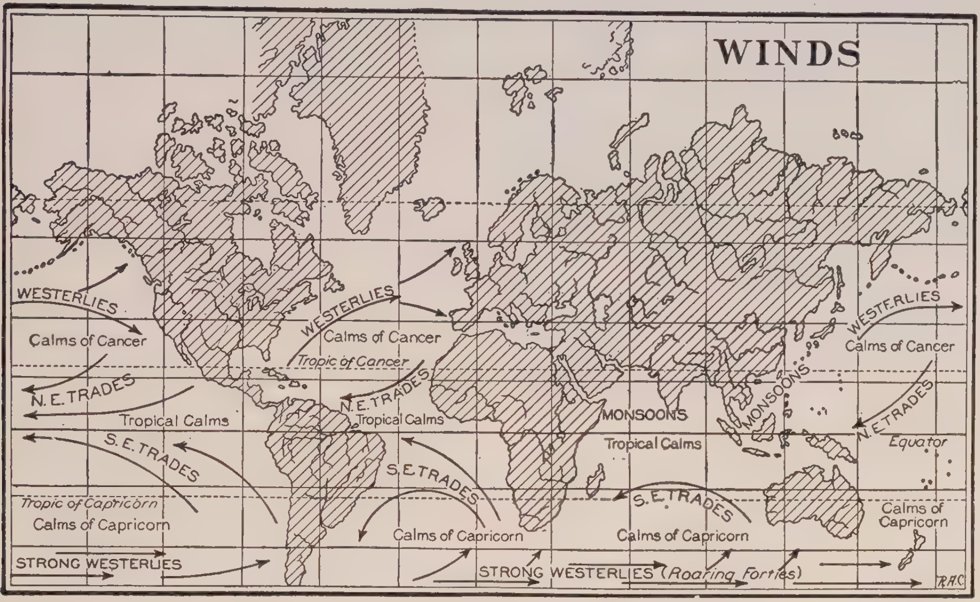
The heating of the air at the equator produces an upward current, which continues until the rising air reaches layers of atmosphere of the same density, when the vertical motion is changed to a horizontal one, and currents set in toward the poles. As the warm air over the equator rises, the cool air on either side moves in to take its place, so that there are in the equatorial regions two sets of currents, blowing towards the equator, and an upper current blowing towards the poles. When the upper current reaches the temperate latitudes it becomes of the same density as the air near the surface and descends, mingling with the surface currents. For this reason there may exist areas where for many consecutive days there is no wind.

Were it not for the rotation of the earth, these currents would blow directly north and south. As it is, each is deflected from its course. The wind blowing toward the equator enters regions having a greater velocity of rotation than those from which it came. It is unable at once to acquire this velocity and, as it were, lags behind, producing easterly winds.

Winds blowing toward the poles are constantly entering regions having a lower velocity of rotation, and their eastward motion is greater than that of the land; hence they become westerly winds. In the northern hemisphere they blow from the southwest, and in the southern hemisphere, from the northwest.

In and near the tropics, these currents are quite regular, but as they approach the temperate latitudes and become nearer equal in temperature and pressure, they are subject to many local influences and become very irregular; hence no theory of wind which accounts for the general circulation of the atmosphere is sufficient to explain the prevailing winds in many localities, and the accounting for these is one of the most difficult problems with which the meteorologist has to contend.

A wind is named from the direction from which it blows; an easterly wind blows from the east, a westerly blows from the west. The force of the wind depends upon its velocity, which is determined by the anemometer, an instrument constructed of four hemispherical cups at the ends of horizontal bars, mounted on a vertical axis and attached to a registering system of clock work.



Related Articles. Consult the following titles for additional information:

Beauford Wind Scale
Calms, Regions of
Cyclone
Khamsin
Land and Sea Breezes
Monsoon
Norther
Prevailing Westerlies
Simoom
Sirocco
Storms
Tornado
Trade Winds
Typhoon
Weather Bureau
Whirlwind

WINDERMERE, *win'dur meer,* the largest lake of England, situated in Westmoreland and Lancashire counties, in the northwestern part of the country. It is ten and one-half miles long and about a mile wide. It contains seven islands, and has steep and rugged shores. The beauty of its scenery inspired Southey, Wordsworth and Coleridge.

WINDHOVER, *wind' huv ur.* See KESTREL.

WIND'LASS, a mechanical device for raising weights with little power. The windlass is a modification of the wheel and axle, and in its simplest form it consists of a mounted cylinder, several inches in diameter, with a square hole at each end, into which bars, called handspikes, can be inserted for turning it. As the roller is turned, it winds a rope or chain, which raises the weight. The windlass used for raising buckets of water from a well has a winch at one or both ends of the roller. The lifting power of a windlass may be greatly increased by fitting a cog wheel between the cylinder and the winch. See DERRICK.

WIND'MILL, a mechanical device which utilizes the energy of the wind for pumping water from wells, for grinding grain, cutting fodder for stock, for running churns, and many other purposes where a small amount of power is needed. The mill in general use on American farms has a wind wheel with radiating wooden or metal slats, placed close together and inclined, though not overlapping. This wheel rotates on a horizontal bar having at its opposite end a vane which keeps the wheel constantly facing the wind. The wheel is mounted on a frame twenty-five or more feet in height, to expose it to the wind's action. The speed of the mill is regulated by a gearing. The amount of power varies with the machine. There are mills which, under favorable conditions, furnish as high as four or five horse power. This type of mill is a distinct improvement upon the old-fashioned Dutch windmill, which has four radial arms covered with canvas. The latter is mounted on a tower on wheels and is turned by hand when a change in wind direction makes it necessary to set the sails to the breeze.

WIND'PIPE. See TRACHEA.

WINDSOR, HOUSE AND FAMILY OF, the name of the British royal family since July, 1917. When Victoria was crowned as queen in 1837, she was of the House of Hanover, the German line which gave Great Britain the four Georges and William IV. It will be remembered that George I knew no English and was not in sympathy with English ideals and traditions; he was more proud of his German title of Elector of Hanover. Victoria married into the House of Saxe-Coburg and Gotha when she took the German Prince Albert as her husband. The family name of Albert was Wettin; it was an illustrious family, coming into prominence in the tenth century. In time by conquest and marriage it controlled several duchies, among them Saxe-Coburg and Gotha.

In 1917, during World War I, the English royal family decided to substitute the name Windsor for that of Wettin, for out of the bitterness of the conflict there had developed a feeling of hostility toward all things German. Accordingly, by proclamation on July 17 of that year, the name was changed from the House of Saxe-Coburg and Gotha to the House and Family of Windsor. The name of George V became George Frederick Ernest Albert Windsor, and that of his son, the Prince of Wales, became Edward Albert Windsor, or, informally, David Windsor. When, in 1936, the latter abdicated as Edward VIII, his successor and brother, George VI, created him Duke of Windsor. See EDWARD VIII.

WINDSOR, *win'zur,* ONT., in Essex County, on the Detroit River, directly opposite Detroit, and on the Canadian Pacific, the Canadian National, the Michigan Central, the Wabash and Pere Marquette railroads. It is connected with Detroit by ferry, by the international bridge and by railway and vehicular tunnels under the Detroit River. It is one of the principal centers in Canada for the manufacture of automobiles and drugs, and also has large steel mills, machine shops, and a salt refinery that is one of the largest in the Dominion. Windsor was first settled in 1812. Population, about 120,000.

WINDSOR CASTLE, one of the most magnificent royal palaces in the world, situated at Windsor on the Thames, about twenty miles from London. Windsor was the residence of the Saxon kings before the Norman Conquest.

William the Conqueror first built a royal residence there, and succeeding rulers have added to, torn down and rebuilt it. The present structure was completed in the reign of George IV. The castle consists of buildings surrounding two great courts, between which is the round tower, or keep, the oldest part of the structure, built by Edward II. Saint George's chapel, an imposing part of the castle, is a fine example of Gothic flamboyant architecture. It has a vault, in which are buried many members of the royal family, among whom are Henry VI, Edward IV, Henry VIII, Jane Seymour, Charles I, and George IV, V, and VI. Adjoining this is Albert Chapel, one of the most beautiful of memorial buildings, built by Henry VII as a mausoleum. Under James II it was used as a Roman Catholic chapel, and after this it was neglected until George III rebuilt it as a royal tomb.

It was Queen Victoria who finished it in the most sumptuous manner, as a memorial to her husband, Prince Albert. Besides the private rooms of the royal family, there are richly furnished state apartments. See illustration, in the article ENGLAND.

WIND'WARD ISLANDS, a group of islands of the West Indies embracing Saint Lucia, Grenada, Saint Vincent and a chain of smaller islands, all under a British governor-in-chief. The islands are so called because of the fact that they are exposed on their eastern sides to the trade winds. See LEEWARD ISLANDS; WEST INDIES.

WINE, the fermented juice of fruits, particularly of grapes. The grape sugar contained in grape juice is readily changed through fermentation into alcohol. The process of manufacture is simple. To separate the juice the grapes are placed in a crushing machine having two corrugated cylinders which crush the grapes without crushing the seeds. The *must,* as the resulting mass of pulp is called, is then forced by pumps through hose to large wooden vats or tanks, where the fermentation takes place.

The fermentation is watched with the greatest care, for upon it depends the quality of the wine. It is hastened by raising the temperature or by placing in the must a small quantity of fermented pulp from another vat. When the fermentation is completed, the juice is strained from the pulp and placed in large reservoirs, called *tuns,* where it remains until the wine is ripe. It is then drawn into casks or bottles and is ready for market.

Wines are known as *dry* when complete fermentation takes place and all the sugar is converted into alcohol. When fermentation is arrested while there is yet some sugar, the result is a sweet or fruity wine. A sparkling wine is one which effervesces when the bottles are uncorked. Champagne is a good illustration. In such wines fermentation has been arrested before all the carbonic acid has escaped. In color, wines are known as *red* or *white.* Red wines are produced by allowing the skins of the grapes to remain in the vat during fermentation. The amount of alcohol in wine varies from 16 to 25 parts in 100. In light wines it may be from 7 to 12 parts in 100.

Wines are manufactured in almost endless variety, and many of them are named from the locality in which they are made, such as Port, Burgundy, Bordellais and Rhenish wines. The leading countries in the world in the manufacture of wine are France, Spain and Italy. In the United States wine has been extensively manufactured in California. Excellent wines are also produced in New York, Ohio, Virgina and other states.

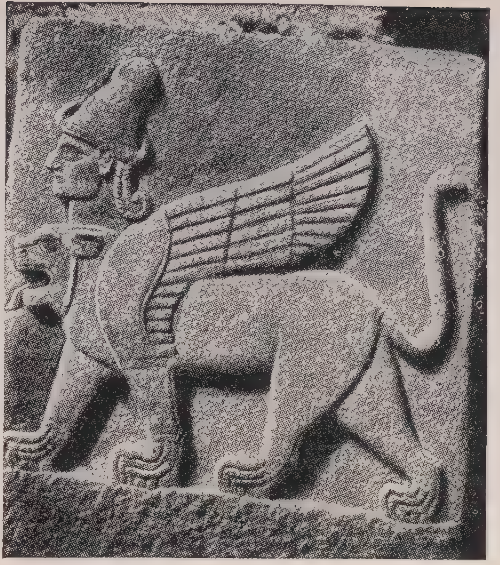
Related Articles. Consult the following titles for additional information:

Champagne	Port Wine
Grape	Sherry

WINGED BULL, a type figure of ancient Assyrian sculpture. It was customary to place winged bulls with human heads before the entrances of royal palaces, as it was believed they guarded the buildings from enemies. Some of the larger bulls were seventeen feet high. The wings of the creatures were carved on huge plinths that covered the wall, while the body projected from the wall, the head and breast being outside the arch of the entrance.

Similar to the winged bull was the winged lion (see illustration). The bull typified strength; the lion symbolized courage.

WINGED LION, a famous piece of bronze sculpture representing a lion with wings. It is the emblem of St. Mark, and was cast in 1178 for the embellishment of one of the two large columns at the south end of the extension to Saint Mark's Square, Venice.



ASSYRIAN WINGED LION

WINGED VICTORY or **NI′KE OF SAM′OTHRACE,** a famous piece of antique sculpture, dug up in 1862 on the island of Samothrace, in the Aegean Sea, and placed in the Louvre, Paris. Nike, the Greek goddess of victory and winged messenger of Zeus and Athene, is here represented as standing on the prow of a ship, her transparent draperies whipped by the breeze. The statue, it is believed, was made to commemorate some military victory of the Greeks. It is badly mutilated, but what remains of it is treasured for its buoyant vitality, its sinuous grace and the noble dignity of its poise. In the Louvre the statue was placed at the head of a staircase. See SCULPTURE.

WINKELRIED, *vin′kel reet,* ARNOLD, a Swiss patriot, who, if legend be true, brought about the independence of Switzerland. According to the popular story, at the Battle of Sempach, when the Swiss were fighting for liberty against their Austrian oppressors, Winkelried, who was only a poor peasant, conceived the idea of leading his countrymen in close triangular formation. By deliberately sacrificing their lives they drove a wedge into the enemy and thus made a breach which opened the way for a successful attack and victory.

WINNEBA′GO, an important Siouan tribe, now numbering about 2,000, who live in Wisconsin and Northeastern Nebraska. When the Jesuits met the Winnebagos, they held a broad tract in Central Wisconsin, near Green Bay and Lake Winnebago. They were a tractable people, but many of them died from the ravages of smallpox, and their numbers greatly diminished.

WINNIPEG, Lake, a lake situated in the south-central part of Manitoba. It has an area of 9,459 square miles, and is a little larger than the state of Vermont. The southern half is in the form of a narrow arm, which extends southward to within about thirty miles of the city of Winnipeg. Its entire length is 260 miles, its greatest width about sixty miles and its greatest depth 100 feet. It receives the Winnipeg, the Red River of the North and the Assiniboine on the south, and the Saskatchewan on the west. Its outlet is by the Nelson River, which, after flowing through several small lakes, reaches Hudson Bay. The fisheries are the most important in Manitoba, yielding $400,000 annually.

WIN′NIPEG, Manitoba, the capital of the province, the county town of Selkirk County and the fourth largest city of Canada, is situated at the confluence of the Assiniboine and Red Rivers. It is about 66 miles north of the United States boundary and practically midway between Montreal and Vancouver. Its geographic position is unique; it lies in a great plain, midway between Lake Winnipeg and the international boundary, and is thus like a spout through which all the trade between eastern and western Canada must flow. It is entered by two great railway systems, the Canadian Pacific Railway and the Canadian National Railway, and their repair shops are among the largest industries of the city. The Great Northern and Northern Pacific lines give the city direct communication with Minneapolis and Saint Paul and other important commercial centers in the United States.

Winnipeg is a great wholesale center, and its manufactures are increasing in importance. It has over 400 factories, whose total annual output exceeds $75,000,000. The wholesale trade in normal times averages $250,000,000 a year. Over sixty buildings of the agricultural college were completed in 1920; there are a number of colleges, including the University of Manitoba, Saint John's College, Wesley College, Manitoba College and Manitoba Medical College. The city is well built, with wide, regular streets and many beautiful buildings, among which are the city hall, the post office, the parliament buildings, the courthouse, Carnegie Library, the new Fort Garry Hotel, Eaton's department store, two great railroad stations and the Hudson's Bay Company, McArthur, Sterling Bank and Ideal buildings.

The site of Winnipeg, in a rich river valley, early attracted settlers. The Hudson's Bay Company in 1812 erected Fort Douglas, which protected the colonists sent out by the Earl of Selkirk; these colonists were the first real settlers in Manitoba. Fort Garry, built in 1822 and rebuilt in 1835, was for years the seat of government in the Red River Valley. In 1873 the city of Winnipeg was incorporated. Its growth has been rapid, and it has enjoyed great prosperity.

In 1919 the most serious strike in its history occurred. Practically all of the union men stopped work, and for several weeks the situation was grave. The city government called for citizen volunteers to act as policemen, and they carried on public activities until the strike was broken. In 1870 the city had 215 inhabitants; by 1901 its population was 42,340; by mid-century it had increased to about 236,000.

WINNIPEGO′SIS, Lake, a lake in the southwestern part of the Canadian province of Manitoba, lying west of Lake Winnipeg and northwest of Lake Manitoba. It has an area of 2,086 square miles, and is 122 miles long and twenty miles in width at the widest part. Small boats can safely ply the lake, but numerous shallow places prevent navigation of large vessels. Its waters are stocked with whitefish and pike, and it is much in favor with anglers. The lake discharges into Lake Manitoba through the Waterhen River.

WINO′NA, Minn., the county seat of Winona County, 103 miles southeast of Saint Paul, on the Mississippi River and on the Chicago, Burlington & Quincy, the Chicago & North Western, the Chicago Great Western, the Chicago, Milwaukee, Saint Paul & Pacific and the Green Bay & Western railroads. Winona conducts a large trade in grain, lumber and livestock. Its industrial plants include flour mills, railroad shops and manufactories of tire chains, drugs, medicines, extracts, toilet preparations, tinware, malt, furs, gloves, wood products, farm implements, food products and other articles.

There is a state teachers college here—the first teachers college to be established west of the Mississippi River. Other educational institutions are the College of Saint Teresa for women and Saint Mary's College for men. Winona is partially surrounded by bluffs of peculiar rock formation, Sugar Loaf and Trempeauleau mountains being particularly picturesque. The place was settled in 1851 on the site of an old Indian village; it was chartered as a city in 1857. Population, about 25,000.

WINSLOW, John Ancrum (1811–1873), an American naval officer, commander of the *Kearsarge* in the battle between that vessel and the Confederate cruiser, *Alabama,* in 1864. The *Alabama* was sunk, and Captain Winslow, who had already won distinction in battle, was promoted to the rank of commodore. After the Civil War he commanded the Gulf squadron and later the Pacific squadron. He was made rear-admiral in 1870.

WIN'STON-SA'LEM, N. C., the county seat of Forsyth County, 110 miles west of Raleigh, on the Norfolk & Western, the Southern and the Winston-Salem Southbound railroads. There is regular air transportation. One of the leading industrial cities of the South, Winston-Salem has the world's largest tobacco-manufacturing plant; one of the largest leaf-tobacco markets in the world, where about 50,000,000 pounds of bright leaf tobacco are sold annually; extensive hosiery and underwear mills; and about seventy-five other plants, producing air conditioning machinery, textile products, furniture, metal products and other articles. Salem College and Academy for women, the medical school of Wake Forest College and Winston-Salem Teachers College for Negroes are here. Salem was founded in 1766 by the Moravians and was for a time governed as a Church community. Winston and Salem were consolidated to form the present city in 1913. Population, about 88,000.

WIN'TER, the season of the year between autumn and spring, beginning with the winter solstice, about December 22, and ending with the vernal equinox, about March 21. In the United States, the months December, January and February are commonly regarded as the winter months, although winter does not begin until December 21 or 22.

WIN'TERGREEN, a small plant, several inches high, which grows in the woods of the northern hemisphere. Glossy, oval leaves, green all winter, grow on the ends of reddish stems. Small white or pink flowers spring from the base of the leaf stems and scarlet berries follow them. The leaves yield an oil which is much used for flavoring and for medicinal purposes.

WINTHROP, John (1588–1649), one of the early colonial governors in America, and one of the most admirable characters in early American history. He was born at Edwardston, Suffolk, England, of wealthy parents, and was educated at Trinity College, Cambridge. Puritan zeal prompted him to share the fortunes of the colonists, and in 1629 he sailed to America with 900 emigrants as governor of Massachusetts Bay colony. From then until the time of his death he worked for the spiritual and material interests of his people.

Winthrop helped to organize the New England Confederation, and was its first president. His *Journal* is a valuable record of New England events from 1630 to 1649.

WIRE, metal drawn into an even thread or slender rod, usually cylindrical in form. The metals most commonly employed in the making of wire are gold, silver, copper and iron. The finest wire is made from platinum. Wire was formerly produced by hammering metal into plates which were then cut into strips and rounded by beating. In modern wire manufacture, steel or iron billets are heated in a furnace to white heat and put through several trains of rolls, emerging from the last roll about a quarter of an inch in diameter. These rods are wound on reels while still hot, are coiled, boiled in sulphuric acid for cleaning, washed in water, coated in lime, baked for two hours at low temperature, and then turned over to the wire drawer.

In order to draw these prepared rods into wires of smaller diameter, the workman pulls them through a series of steel dies by means of a cast-iron reel. Very fine wires may be drawn as many as twenty times, each time through smaller holes. As the process of drawing causes brittleness in wire, it must be annealed as occasion demands by heating in cast-iron pots, this process always being followed by an acid bath for cleaning. Wire used for small springs or nails, when hardness is an essential, is not annealed. For drawing very fine wires of gold, silver or platinum, dies of diamonds, rubies or other hard stones are used. Wire for outdoor use is galvanized to prevent rusting.

The uses of wire are innumerable, from the forming of the gigantic steel cable, with a tensile strength of 130 tons to the square inch, to the delicate micrometer of the telescope, employing platinum wires as fine as $\frac{1}{50,000}$ of an inch in diameter. Telephone and telegraph wires, trolley wires, wire netting and wire fencing are some of the most common uses. In wartime immense quantities of barbed wire are used to form barriers to enemy advance.

WIRE GLASS, window glass made with an inside mat of open mesh wire. The wire is embedded in the molten glass at a temperature sufficiently high to insure adhesion of the glass to it. The surface of the pane can be finished in such style as to adapt the glass for different uses. It may be ribbed, polished or "rough rolled." Wire glass is strong, and is used for window panes where ordinary glass is apt to be broken. It is one of the most efficient safeguards against fire, since, if broken by heat, it does not fall. Two men claim the invention of wire glass, Frank Schuman of Philadelphia and Leon Appert of France.

WIRELESS TEL′EGRAPH. See Telegraph, Wireless.

WIRELESS TELEPHONE. See Telephone, Wireless.

WIRE′WORMS, a name commonly given to the larvae, or grubs, of several species of click beetles. The worms are hard, slender and cylindrical and of a brown or yellowish color. They bore into seeds that are in the germinating stage, and are especially destructive, to grain seed. They also attack roots of grains, vegetables, grass and cotton. The adults lay the eggs in sod and grassland, and the larvae are full-grown by mid-summer. Their life cycle is from three to five years. For the adult insect, see Click Beetle.

WISCONSIN, a North Central state of the American Union, one of the foremost American commonwealths in educational and political matters, and industrially one of the most prosperous. Wisconsin is popularly called The Badger State, referring to the habits of the lead miners in early days, who lived in rude dugouts, after the fashion of the badger. The name *Wisconsin* is of Indian origin, and has been variously interpreted to mean *rushing river* and *great rocks.*

Location, Area, Population. Wisconsin lies north of Illinois and east of Minnesota and Iowa; nearly all of the western boundary is formed by the Saint Croix and the Mississippi rivers. A good portion of the eastern boundary line lies in Lake Michigan; the state adjoins the state of Michigan on the northeast, and at the extreme north it follows the shore line of Lake Superior. With a maximum length of 320 miles and a width of 295 miles, the state is irregularly oblong in shape and has an area of 56,154 square miles; of this total, 1,449 square miles are water. Among the states Wisconsin is twenty-fifth in size. It was fourteenth in population at the 1950 census, which reported 3,434,575 Wisconsin inhabitants. The density of population was 62.8, giving the state twentieth place in number of persons per square mile. The urban population of Wisconsin was reported as 57.9 per cent.

Peoples and Cities. The founders of the state came largely from New England and New York State. The foreign-born at one time made up a third of the population, but their ratio to the total number has declined. Germans constitute one-third of the foreign-born; next in order are Poles, Norwegians, Czechoslovakians, Swedes, Russians, Canadians and Englishmen. There are thirty-three cities with populations of 10,000 or over. Milwaukee, with a population of 637,392 in 1950, is the largest city in Wisconsin. The 1950 census ranked it thirteenth in the nation. The next seven cities, in order of size, were Madison (the capital), Racine, Kenosha, Green Bay, La Crosse, West Allis, and Sheboygan.

The chief religious bodies are the Roman Catholics, Lutherans and Methodists. Nearly one-fourth of the people are Roman Catholics and about one-sixth are Lutherans.

Surface and Drainage. The surface of Wisconsin is generally a great rolling plain. A low height of land extends through the state north and south, a little east of the middle line, and at a point about 30 miles south of Lake Superior it meets another ele-

WISCONSIN

THE BADGER STATE

(1) Grain harvest; (2) logs for pulp; (3) water power for paper making; (4) heavy machinery; (5) cheese; (6) canning; (7) resort country.

vation extending east and west. The highest altitudes of this ridge are about 1,800 feet. These ridges form watersheds from which the land slopes in all directions. There are no high mountains in the state, but the rivers flow through well-worn valleys in some localities; and along the Mississippi and other streams there are bluffs. There is also a very conspicuous bluff along Green Bay. The lowest part of the state borders on Lake Michigan, which is slightly less than 600 feet above sea level.

Wisconsin is divided into three drainage areas. The northwestern part of the state is drained into Lake Superior by a few short rivers, chief of which are the Montreal and the Bois Brule. The area east of the watershed extending north and south is drained into Lake Michigan, and with the exception of the Fox, all of the rivers in this region are short. Some of the most important are the Menominee, forming a large part of the boundary between Wisconsin and the northern peninsula of Michigan, the Peshtigo and the Oconto.

Nearly three-fourths of the state is drained into the Mississippi River. The chief tributaries are the Saint Croix, forming a part of the western boundary, the Chippewa, the Black, and the Wisconsin, which flows through the central part of the state and is the largest river wholly within its boundaries. Each of these rivers has numerous tributaries, but none of them is navigable for large boats. Through a part of its course the Wisconsin has cut its way through sandstone bluffs, forming the Dells (or Dalles, which see), noted for their beautiful scenery. In the southeastern, north-central and northern parts of the state are numerous lakes which are the favorite resorts for summer residents and also for hunters and fishermen. The largest of these is Lake Winnebago, almost directly south of Green Bay. Lakes Geneva and Mendota are noted for their beautiful landscape setting. The former is a popular summer resort; on the latter is the city of Madison, seat of the state university.

Climate. The winters are long and severe, but of uniform temperature, with many dry, clear days; the summers are short and hot. But the cold of winter and the heat of summer in the eastern section are tempered by the waters of Lake Michigan. In northern Wisconsin, snow usually falls early in the winter and covers the ground until late in the spring; in the south there is often little snow. The average rainfall is 30 inches.

Mineral Resources. Though the state derives much greater income from agriculture than from mining operations, it has valuable deposits of zinc, building stone, iron ore and clays. The total annual mineral output is valued at about $18,000,000. The most important building stones are granite, limestone and sandstone, with an annual value of over $5,000,000. Iron, zinc and lead are important products. Iron ore is found in the valley of the Menominee River and along the Penokee range in the northern part of the state. The deposits are a continuation of those in Michigan and Minnesota, and the ores are similar in quality. In quantity of output, however, Wisconsin is far behind Michigan and Minnesota. The products of each year often are valued at about $3,000,000. Clay suitable for making brick and tiling is widely distributed, and the manufacture of cream-colored brick is one of the most important industries of the state. Other products of value include natural cement, graphite and mineral waters.

Agriculture. Originally a large part of the state was covered with forests; in the north the principal timber was pine. Regions between the forests consist of marsh or land covered with boulders. Hence this part of the state is not suited to general agriculture, but it is well adapted to dairying; this industry has been extensively developed. The middle and southern portions of the state consist of fertile prairie lands. They are supplied with an abundance of moisture, and the temperature is suitable for growing all crops produced in a medium or cool temperate climate.

Oats and corn are the most important grain crops; the annual harvest of oats at times exceeds 100,000,000 bushels. About 4,000,000 tons of hay are produced each year. Barley and rye are raised in large quantities; buckwheat is another important product. In the central region of the southern group of counties is a fertile tobacco belt by means of which Wisconsin holds seventh place among the states in the amount of tobacco raised. Sugar beets, potatoes, beans, peas, apples and small fruits are other flourishing products. The state is one of the few regions in America producing cranberries on a commercial scale; it is one of the first five states in the production of peas and beans.

Dairying is one of the most profitable lines of agriculture, and Wisconsin produces more cheese than any other state. Minnesota alone exceeds it in the output of creamery butter. Cows and heifers number more than 2,000,000; to them must be added 1,000,000 other cattle.

Manufactures. Wisconsin ranks tenth among the states in manufactures. In 1880, when wheat was still a leading crop, flour and grist-mill products were first among her manufactures. Subsequently lumber and timber stood at the head of the list; still later butter, cheese and condensed milk stood first.

There is a great diversity of manufactures; among these motor vehicles stand first with a yearly value of about $219,000,000, while motor vehicle bodies and parts and rubber tires and tubes are worth an additional $136,000,000. Butter, cheese and condensed milk are worth $203,000,000. Other industries are foundry and machine shop products, paper and wood pulp, engines, turbines, wholesale meat packing, boots and shoes, knit goods, electricial machinery and aluminum. Milwaukee holds a leading position in brewing.

Transportation and Commerce. The western part of the state has an outlet through the Saint Croix and the Mississippi rivers; the northwestern section sends freight through Lake Superior; while the eastern portion, bordering in its entire length upon Lake Michigan, has communication with the Great Lakes through Racine, Milwaukee, Sheboygan, Manitowoc, Sturgeon Bay and other points.

Wisconsin maintains about 7,300 miles of steam railways. The leading railroads are the Chicago, Milwaukee, Saint Paul & Pacific, the Chicago & North Western, and the Minneapolis, Saint Paul & Sault Ste. Marie, commonly called the "Soo." This line became a subsidiary of the Canadian Pacific and many years ago absorbed the old Wisconsin Central and thus gained connection with Chicago. The Green Bay & Western is the longest line extending wholly within the state. Several railroads developed to a great extent in other states have only a small mileage in Wisconsin; such are the Chicago, Burlington & Quincy, the Illinois Central and the Northern Pacific. Four strong bus companies have absorbed much of the traffic formerly carried by the interurban electric lines. Three interstate air lines serve Wisconsin.

The commerce of the state is extensive. Iron, dairy products, live stock, lumber and its manufactured products, flour and grist-mill products, potatoes and other vegetables are exported in large quantities. The imports consist of manufactured goods and machinery.

Government. The legislature consists of a senate and a house of representatives, the senate having thirty-three members, and the house, 100. The members of the assembly are elected for two years; of the senate, for four years. The sessions are biennial and are unlimited as to time. The executive department consists of a governor, a lieutenant-governor, a secretary of state, a treasurer and an attorney-general, each elected for two years, and the superintendent of public instruction, chosen at a spring election for a four-year term. In the judicial system there are the supreme court of seven judges elected for ten years, and the circuit courts in the several judicial circuits established by the legislature, each circuit having one judge elected by the people.

Much of the work of government in Wisconsin is done by departments either established or put into present form within the twentieth century. Each of these greater departments is headed by a group of three persons, usually called commissioners. They are appointed by the governor, subject to confirmation by the senate, for six years; terms are arranged to overlap so that commissions may never lack experienced members.

The list of these commissions is as follows: public service, highway, industrial, commissions; board of control for state institutions; tax and banking commissions; and the department of agriculture.

Education. Wisconsin has a system of public education extending from the kindergarten through the graduate and professional schools of the state university. The elementary and secondary schools care for more than 800,000 pupils and cost about $22,000,000 annually; and the total yearly expenditure of the state and its subdivisions for all types of education is about $70,000,000. The University of Wisconsin at Madison is at the head of the system, and is directly affiliated with the high schools throughout the state. There are nine institutions which began work as normal schools, but they are now called state teachers' colleges, and grant bachelors' degrees to graduates of their four-year courses. They are located at Milwaukee, Oshkosh, Platteville, River Falls, Stevens Point, Superior, Whitewater, La Crosse and Eau Claire; their aggregate enrollment is not far from 7,000. The state also supports Stout Institute at Menomonee in Dunn County, a nationally known training school for teachers of home economics, manual training and other vocational subjects. Wisconsin has a unique system of county training schools to prepare teachers for the rural schools. It has also been a great leader in vocational education. In connection with its educational department, Wisconsin maintains an excellent system of school libraries, which are so managed as to bring a large list of the best books within reach of every inhabitant of the state, at practically no expense. The traveling libraries have no connection with the educational department, being promoted by the state library commission. The library of the historical society at Madison is also one of great value. Another agency for extending popular education is the excellent extension system of the state university (see Wisconsin, University of).

Important institutions of higher learning not under the control of the state include Beloit College at Beloit, Lawrence College at Appleton, Ripon College at Ripon, Milton College at Milton, Carroll College at Waukesha and Milwaukee-Downer College at Milwaukee. Of somewhat later foundation are Marquette University and Mount Mary College (for women), both of them Roman Catholic institutions located in Milwaukee.

Other Institutions. The school for the blind is at Janesville; the institution for the deaf and dumb is at Delavan; there are schools for the feeble-minded and epileptic at Chippewa Falls and at Union Grove in Racine County; the state public school for dependent children is situated at Sparta. There are hospitals for the insane at Mendota and Winnebago and a hospital for the criminal insane at Waupun; the incurable insane are cared for in county institutions which receive state aid. A state tuberculosis sanitorium was established at Wales in 1905 and later it was supplemented by a camp for male convalescents at Lake Tomahawk in Oneida County. There are also nearly twenty state-aided county tuberculosis sanitoria.

There is a state soldiers' home at Waupaca

Items of Interest on Wisconsin

Wisconsin was the last complete state made out of the Northwest Territory. There still remained as much of Minnesota as lay east of the Mississippi River, so that altogether the Northwest Territory became five and a half states.

Wisconsin's climate is marked by much sunshine and high temperature in summer and by clear sky with low temperature in winter; the climate is tempered to a limited degree by the large bodies of water east and north.

Many of the wild animals have been killed off, but deer are still plentiful in the northern part of the state, and wolves, black bears and foxes are occasionally seen; waterfowl of all kinds are abundant and fishing is both a great sport and an important business.

In Grant County there is a huge mound shaped like an elephant, with a trunk thirty-two feet long. This is a relic of the Mound Builders of prehistoric times.

Wisconsin's many lakes, waterfalls and rapids are the result of glacial action.

School attendance is compulsory for all children between the ages of 7 and 14, in cities for the entire school year and in towns and villages for six months. Public schools are open to pupils aged 5 to 21.

The highest point in the state, Rib Hill, is in Marathon County. It has an altitude of 1,940 feet.

Questions on Wisconsin

Describe briefly the surface and drainage of Wisconsin.

Name five important agricultural products and four minerals.

What can you say about the importance of dairying in Wisconsin?

What is the most important manufacturing industry?

Name five other manufacturing industries.

Name five important agricultural institutions.

Explain, as fully as you can, Milwaukee's importance in commerce and manufactures.

and a national soldiers' home at Milwaukee. The penal and reformatory institutions consist of a state prison at Waupun, a state reformatory near Green Bay, an industrial school for boys at Waukesha, a house of correction and industrial school for girls at Oregon and an industrial home for women in Fond du Lac County.

History. Probably the first white man to enter the territory of Wisconsin was Jean Nicolet, who was dispatched in 1634 by Champlain and who reached the shores of Green Bay. Other traders and missionaries followed, including Radisson and Groseilliers, Father Allouez and Marquette and Joliet. Meantime, several missions had been established, one at La Pointe on Lake Superior in 1665 and one at the site of De Pere in 1669. By the Treaty of Paris, in 1763, the territory, with all the northwest, was transferred to Great Britain and, after the Revolution, to the United States, where it formed a part of the Northwest Territory. However, the French and Indians in the region still remained hostile to the United States and fought against it during the War of 1812. The discovery of lead mines eventually brought on a rapid influx into the territory, and after the defeat of Black Hawk there was a large agricultural immigration.

Wisconsin was successively joined to Indiana and Michigan; it was erected into a separate territory in 1836. In 1847, the population of the state having been vastly increased, a constitution was adopted, and Wisconsin was admitted to the Union in the following year. For a time the chief incident in the political history of the state was the scandal arising from the promiscuous granting and sale of public lands to railroads. One of the first movements leading to the organization of the Republican party was a convention at Ripon, Wis., in 1854. The state was consistently opposed to slavery, and its supreme court declared that the Fugitive Slave Law was unconstitutional in the state. Since the Civil War, Wisconsin has been almost consistently Republican in politics. However, after 1901, it came to be largely dominated by the progressive element under the leadership of Robert M. La Follette, Sr., and his two sons. The Progressive Party, established in 1924 by the elder La Follette (then Senator) and others, carried Wisconsin that year, but was never given a permanent organization. In 1934, the La Follette brothers organized a state Progressive Party, which functioned until 1946, when it voted to rejoin the Republican Party.

Since 1900, Wisconsin has passed many progressive laws, including workmen's compensation, mothers' pension and child labor measures and a law regulating campaign contributions. Wisconsin was the first state to enact a plan for unemployment insurance.

Related Articles. Consult the following titles for additional information:

CITIES

Appleton
Ashland
Beloit
Eau Claire
Fond du Lac
Green Bay
Janesville
Kenosha
La Crosse
Madison
Manitowoc
Marinette
Milwaukee
Oshkosh
Racine
Sheboygan
Stevens Point
Superior
Waukesha
Wausau

PHYSICAL FEATURES

Great Lakes, The
Mississippi River
Wisconsin River

HISTORY

Black Hawk
La Follette, Robert M., Sr.
Northwest Territory
Ordinance of 1787

WISCONSIN, UNIVERSITY OF, one of the largest and most progressive of the American state universities; instruction began at Madison in 1849.

The university stands at the head of the educational system of the state and gives free tuition to students who are residents in Wisconsin, in all departments except in the library school and the Wisconsin High School. Through an admirably equipped and organized extension department thousands of persons unable to attend regular university sessions are given exceptional advantages. The university maintains three colleges--letters and science, engineering, agriculture; six schools—law, medicine, nursing, education, library, graduate; two divisions—physical education and university extension. The United States Weather Bureau and the United States Forest Products Laboratory are associated with the university, as well as the Washburn Observatory, the Wisconsin Geological and Natural History Survey and the Wisconsin Psychiatric Institute.

The library building is one of the finest in the United States; it contains over 600,000 volumes. Adjacent is the library of the Wisconsin State Historical Society and the library of the Academy of Sciences, Arts and Letters. During the regular session there are about 23,500 students in residence; the faculty numbers about 1,800.

WISCONSIN RIVER, the principal river of the state whose name it bears. It rises near the boundary between Michigan and

Wisconsin, flows southward to Portage City, thence in a southwest direction, entering the Mississippi River four miles south of Prairie du Chien. Its length is about 600 miles, and it is navigable for steamboats to Portage City, about 200 miles. Here a canal connects it with the Fox River. Its passage through some deep gorges forms the celebrated Dalles, near Kilbourn City.

WISTA'RIA, a climbing shrub of the pea family, native to China and North America. Several varieties have been introduced into England. When in flower they are among the most ornamental of garden plants. The flowers, shaped like pea-blossoms, are of various tints and shades of lavender, and hang in clusters which sometimes are several feet long. The Chinese and American species are much used in the United States for garden ornament.

WIS'TER, Owen (1860–1938), an American novelist and story writer, born in Philadelphia and educated at Harvard. He was admitted to the bar, but after two years gave up law work for literature and won wide notice through his stories of Western life. Of these *The Virginian* has been most popular. Owen Wister wrote biographies of *Grant, Oliver Wendell Holmes, Franklin,* and *Theodore Roosevelt.* Among his later books are *Lady Baltimore, The Simple Spelling Bee, The Seven Ages of Washington, Members of the Family, The Pentecost of Calamity, The Ancient Grudge, Neighbors Henceforth,* and *Watch Your Thirst.*

WITCH'CRAFT. At all times in the world's history there has existed a belief that some persons, in league with powers of darkness, had powers to cast "spells" or inflict injury at a distance by supernormal means. This belief became general in the fifteenth, sixteenth and seventeenth centuries, and in England and America the use of the supposed power to harm through coöperation of a demon was called *witchcraft,* meaning *craft or practice of a witch.*

Women were most often accused of witchcraft, though men and even children were suspected. Laws were passed to deal with them and persecutions were numerous. It is estimated that in England, Germany, France, Spain and Italy 100,000 innocent persons perished under the charge of witchcraft between the middle of the fifteenth and the middle of the sixteenth century. Various tests were applied to ascertain whether or not the person was a witch, such as pricking the body of the victim all over, to find the insensitive spots protected by the devil, and throwing witches into deep water, under the presumption that they would float if possessed.

The witchcraft frenzy broke out among the Puritans of New England in 1648. In Salem, Mass., Cotton Mather, a clergyman of wide influence and great power as a pulpit orator, wrote a work entitled *Memorable Providences Relating to Witchcraft and Possessions* and another entitled *Wonders of the Invisible World.* By the distribution of his writings and his utterances in the pulpit, he succeeded in arousing the superstition to the highest pitch, at a time when it was beginning to abate in Europe.

Many of the teaching men of the province were influenced by his writings and sermons, and, as clergmen in those days constituted a part of the magisterial authority, he succeeded in procuring the execution of nineteen persons. The good sense of the Puritans at last revolted against these atrocities, and a reaction set in. Samuel Parris, a clergyman, who was one of the chief persecutors, made a confession; others also relented, and there were no more persecutions for witchcraft in the American colonies. In England the last trial for witchcraft was in 1722, and it resulted in acquittal.

WITCH HA'ZEL, a North American shrub which is of economic importance as the source of a healing lotion obtained by distilling the leaves in alcohol. The plant has branches of a very peculiar appearance, for they twist and curve in all directions. In olden times the witch hazel was believed to have supernatural power, and the forked twigs were used as divining rods. The plant does not bloom until late in the fall, and the fruits ripen the following year. The yellow flowers grow in showy clusters. A small, woody capsule encloses the seeds.

WITENAGEMOT, *wit e nah ge mote',* in English history, the name given to the old Anglo-Saxon assembly, which consisted of the king, the ealdormen, the higher ecclesiastics and the thanes. This body had power to elect the king, when a succession was in dispute, or to depose a king if it saw fit, to make treaties, to collect revenue and to enact laws. Under a weak king it was able to exercise all of these functions, but a strong king might easily make most of them merely nominal. The Norman Conquest put an end to this assembly, and the Parliament which grew up later in England was a separate institution, though it had its roots in this early body.

WIT'NESS, in law, (1) one who signs his name as affirmation of the genuineness of another's signature; (2) a person who gives testimony under oath in a judicial proceeding. Any person can be summoned before a court to give evidence. If he fails to appear he is liable to punishment for contempt (see CONTEMPT). The summons by which he is ordered to appear is called a *subpoena*; if he is ordered to bring a document or other thing in his possession, he is summoned by a *subpoena duces tecum,* meaning *bring with you under penalty.*

WITTE, *vit'te,* SERGEI YULIEVITCH (1840-1915), a Russian statesman and diplomat, born at Tiflis. After his graduation from the New Russian University at Odessa, he took up journalism; later he was engaged by the government in railway service. In the Russo-Turkish War Witte had charge of the transportation of troops on the Odessa railway and so distinguished himself that at the close of the war he was made manager of the Southwestern Railway of Russia. Two years later he became chief of the Imperial Railway department and president of the tariff commission. His next promotion was to the office of Minister of Finance, in 1893. His policy in this office led to the rapid development of manufacturing industries in Russia. He introduced the gold standard, made the sale of alcohol a government monopoly, concluded several important commercial treaties, especially with Germany, and made large foreign loans, whereby the Trans-Siberian Railway could be built. In 1903 a strong opposition arose and Witte was removed from power and made president of the Committee of Ministers. At the Treaty of Portsmouth, N. H., at the close of the Russo-Japanese War, Witte was especially prominent. When he returned to Russia, the czar conferred upon him the title of count. In 1905 he was appointed Prime Minister of Russia, but in 1906 he resigned this position.

WITTENBERG, *vit' ten berK,* GERMANY, a town in the province of Saxony, Prussia, situated on the Elbe, fifty-nine miles southwest of Berlin, of special historical interest because of its association with Luther and Melanchthon. It was to the door of the Schlosskirche at Wittenberg that Luther nailed his celebrated theses, and within this church both Luther and Melanchthon are buried. (See LUTHER, MARTIN; MELANCHTHON, PHILIPP; REFORMATION). The town contains a number of educational institutions, in one of which, the University of Wittenberg, Luther for a time was instructor. The industries include the manufacture of woolen and linen goods, hosiery, machinery, pottery, etc. Population, about 25,000.

WOAD, *wode,* a group of plants of the mustard family, chiefly natives of the Mediterranean region. *Dyer's woad,* a species yielding a blue dye, was formerly much cultivated. This has been superseded by indigo; but a fine blue is still obtained by mixing the two. The leaves when gathered are reduced to a paste, fermented for two weeks, made into balls, sun-dried, and again fermented.

WODEN, *vo'den.* See ODIN.

WOLF, a carnivorous animal, allied to the dog. The common European wolf, found almost everywhere in North America also, is yellowish-gray, with a blackish band, or streak, on the forelegs. The ears are erect and pointed. The hair is harsh and strong, the tail straight, bushy and drooping. The height at the shoulder is about two and a half feet. The wolf is swift of foot and crafty, an enemy to animal life. It usually runs in packs to hunt the larger quadrupeds, such as deer and elk. When hard pressed with hunger, these packs have been known to attack isolated travelers and even to enter villages and carry off children. In general,

WOLF

however, wolves are cowardly and stealthy. They are still plentiful in many parts of Europe and North America. They probably ceased to exist in England about the end of the fifteenth century. The small *prairie wolf* or *coyote,* a member of the wolf family, living on the western plains of the United States, is a burrowing animal.

WOLFE, JAMES (1727–1759), a British general, whose victory in the Battle of Quebec, September 13, 1759, won Canada for Great Britain. Wolfe was born at Westerham, Kent, England. He entered the army early and served in Scotland and in Flanders. When it was decided, in 1758, to send an expedition to Cape Breton, Pitt appointed Wolfe brigadier-general. Wolfe advised an attack on Quebec and was selected to lead the enterprise, in which capacity he showed wonderful courage and genius. After having been driven back from the fortress, he led his men, by night, up a steep, narrow path, to the Heights of Abraham, above the city, and here he met the French under Montcalm. While leading a charge, he had one of his wrists shattered by a shot, but he did not stop. Another shot struck him, and he still advanced, but a third lodged in his breast and proved fatal. His last words, when he was told that the French were retreating, were, "Now God be praised; I die in peace." A monument on the battlefield bears a simple inscription in his honor. Another monument is in Westminster Abbey in London, and a third is in Governor's Garden, Quebec.

WOLF FISH, a savage fish that has a mouth armed with sharp, strong teeth. When captured, the fish is said to bite the nets and even to attack the fishermen. Around the coasts of Great Britain it attains a length of six or seven feet, but in more southern seas it grows to a still larger size. In Iceland the natives eat the flesh and make the tough skin into a sort of leather.

WOLFRAM. See TUNGSTEN.

WOLSELEY, *woolz'ly,* GARNET JOSEPH, Sir, Viscount (1833–1913), a British general, born in Ireland. He entered the army as ensign in 1852, took part in the second Burmese War, where he was severely wounded, and served with distinction in the Crimean War. He engaged in the siege and capture of Lucknow during the Sepoy Rebellion, and was in command in 1860 in the Chinese War. In the following year he was dispatched to Canada, and in 1870 he carried the Red River expedition to a successful issue. Three years afterward he was appointed to the command of an expedition to punish the king of Ashanti, and after a brief campaign he entered Kumassi and subdued the king. He was publicly honored and given a grant by the government of $125,000.

He was placed in command in Egypt, in 1882, where his forces successfully stormed the lines of Tel-el-Kebir and captured Arabi Pasha. For this he received the thanks of Parliament, was created a baron and was promoted to the rank of general. In 1882 he was sent to Egypt to rescue General Gordon at Khartum, but arrived two days after Gordon had been killed and Khartum had fallen. On his return to England he was created a viscount. In 1890 he was made commander of the troops in Ireland, and in 1895 he was raised to the supreme command of the British army.

WOLSEY, *wool'zy,* THOMAS, Cardinal (1475?–1530), an English statesman, for many years the most powerful man in England, below the king. He was born at Ipswich, the son of a butcher, and was educated at Magdalen College, Oxford, where he took his degree as a scholar of distinction. When Henry VIII became king, the advancement of Wolsey was rapid. Successively he was appointed canon of Windsor, dean of York, bishop of Lincoln, archbishop of York, lord chancellor of the kingdom, cardinal and Pope's legate.

His power and his revenues were equaled only by those of the Crown. Part of his immense revenues he expended in display, and part for the advancement of learning. He endowed the College of Christ's Church, Oxford, founded several lectures and built the palace at Hampton Court, which he presented to the king. His preferment by the king was largely the result of a remarkable series of diplomatic victories, in which Wolsey had been the means of enabling Henry to hold the balance between Francis I and Emperor Charles V.

In his ambitious career the cardinal had made many enemies, who were held in check so long as he retained the favor of his royal master. This favor Wolsey lost when he failed to obtain from Pope Clement a decision granting the king's divorce from Catharine of Aragon. The enemies of the fallen prelate now succeeded in banishing him from court and stripping him of his dignities.

Finally, after a brief respite, during which he was restored to some of his offices and had returned to his see of York, he was arrested on a charge of high treason. On his way to London, as a prisoner, he died at Leicester Abbey.

WOLVERINE, *wool vur een′.* See GLUTTON.

WOMAN'S CHRISTIAN TEMPERANCE UNION, THE NATIONAL, a woman's organization, founded in Cleveland, Ohio, in 1874, for the purpose of unifying the work of women in temperance and social reform. It now has state, district, county and local societies in every state and territory, and it contains a membership of several thousand. It has over forty lines of work, each under the management of national, state, district, county and local superintendents. The society has been instrumental in securing in nearly every state the enactment of laws requiring the public schools to give instruction in the effects of stimulants and narcotics on the human system; through their influence many laws for the better protection of girls and women have also been passed, and industrial homes for girls and houses of refuge for fallen women have been established. The official organ is the *Union Signal,* published at Chicago. Headquarters of the society are at Evanston, Ill., in "Rest Cottage," the former home of Miss Frances E. Willard.

The World's Christian Temperance Union was formed in 1883, through the influence of Miss Willard. It now has local organizations in most Christian countries. The badge of members everywhere is the white ribbon. See WILLARD, FRANCES ELIZABETH.

WOMAN'S RELIEF CORPS, a patriotic organization founded in Denver, Colo., in 1883, by a group of women desirous of acting in co-operation with the G. A. R. It maintains its organization in most Northern states, though few members of the G. A. R. survive. The specific objects of the society may be stated as follows:

> To aid and assist the G. A. R. and perpetuate the memory of their heroic dead; to find homes for the Union Veterans, their widows and orphans, and to emulate the deeds of our army nurses; to maintain true allegiance to the United States of America; to inculcate lessons of patriotism and love of country among our children and in the communities in which we live; to encourage the spread of universal liberty and equal rights to all.

WOMAN SUFFRAGE, the right of women to vote. The fight for woman suffrage, which began in earnest in the nineteenth century, is a part of the larger struggle of women to share the rights and privileges which men have enjoyed for centuries and to escape from their old status as the "inferior" sex. Today, women vote in most of the important free nations of the world.

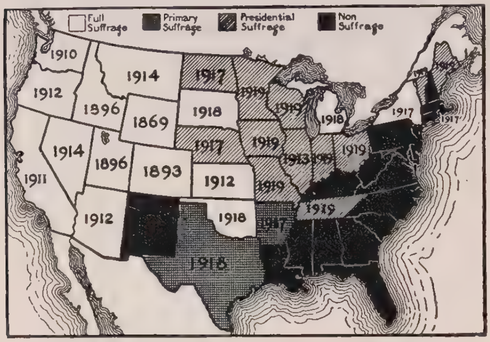
Philosophers, idealists and reformers championed the cause of woman suffrage for centuries before any practical gains were achieved. In the nineteenth century, the widespread spirit of democracy finally brought results. New Zealand led the way by granting woman suffrage in 1893. Before the end of World War I, Finland, Norway, Australia, Denmark, Iceland and Russia had followed suit.

The abilities of women won new recognition as a result of their contributions to the war effort. In Great Britain, where Mrs. Emmeline Pankhurst had led a most militant woman suffrage movement for many years, women over thirty were given the right to vote in 1918. Canadian women were allowed to vote in national elections, and woman suffrage was adopted by most of the democratic governments set up in postwar Europe. Democracy, and woman suffrage, declined in Europe in the 1920's and 1930's, but during this period women won the vote in parts of South and Central America.

World War II brought another swing towards democracy. Woman suffrage was accepted in France in 1944, in Italy in 1945 and in Japan in 1946. Some or all women can now vote in such countries as China, Turkey, India, Mexico, Thailand, Belgium, the Philippines, Greece, Uruguay, and Ecuador. In Argentina, voting is compulsory for women over eighteen. Absolute governments render the vote practically worthless in some countries having universal suffrage.

In the United States. In the United States the movement for woman suffrage really dates from 1848, when the first woman suffrage convention was held, in Seneca Falls, N. Y. Among its leaders were Elizabeth Cady Stanton and Lucretia Mott. In 1869, through the efforts of Mrs. Stanton and Susan B. Anthony, the National Woman's Suffrage Association was formed. In 1890 this organization united with one founded the same year by Henry Ward Beecher, and the name National American

Woman's Suffrage Association was adopted. The organization, in co-operation with numerous state societies, worked tirelessly for the extension of women's political rights, and in 1919 a woman suffrage amendment to the Constitution passed both Houses of Congress. It was sent to the states for ratification, and in August, 1920, this was accomplished. By referring to the map the reader may see the progress of the movement.



BEFORE THE AMENDMENT

The map shows the status of women suffrage on August 1, 1920. The white areas were full-suffrage states; slanting lines indicated presidential suffrage; squares, primary suffrage; black, no suffrage. A Constitutional amendment to grant suffrage to all women of the United States passed the House of Representatives on May 21, 1919; the Senate, June 4. It was ratified in 1920.

WOM'BAT, a burrowing mammal belonging to the same order as the kangaroo, having the characteristic pouch for carrying the young (see MARSUPIALS). Wombats are found only in Australia and Tasmania. They look somewhat like small bears, are two to three feet in length, and have a coat of long, coarse fur, yellowish black or grayish brown in color. The head is broad and flat, the eyes and ears are small, and the tail is short. The creatures feed on leaves, roots, and vegetables, coming out of their burrows at night in search of food. Their flesh resembles pork in taste. The fur is used in making rugs and mats.

WOMEN'S CLUBS. With the increase in facilities for the education of women and with their growing share in public life, came the feeling of the necessity for co-operation along lines in which they were interested. The first societies of women were religious, charitable, and social organizations. As educational advantages were extended to women, study clubs sprang up among them, and from these have developed the highly efficient women's organizations of today.

At present there exist in the United States a great number of clubs for women. A great many of these clubs are *departmental*, that is, are divided into groups interested respectively in literature, household economics, municipal improvements, politics, and so on, each group co-operating with the others and the interests and activities often overlapping. Others are devoted exclusively to politics, art, travel, domestic science, or are made up of members of some profession.

Within recent years women's clubs have brought about many reforms in school administration and municipal management. They have turned their attention systematically to promoting child welfare, improving the condition of working women, and awakening the public conscience generally to a realization of the need of reform. In many cities, owing to their influence, vacant property has been converted into playgrounds or into kitchen gardens for the poor. Prisons, asylums, charitable organizations, dance halls, and innumerable other institutions have felt their influence.

The General Federation of Women's Clubs is the largest women's organization in the world. It includes more than 15,000 clubs, and these are found in every state of the Union, in Alaska and other territories, and in many foreign countries. It is a federation of clubs representing great diversity of interest, but it excludes sectarian, political, and secret organizations. The General Federation was first planned in 1889 and formally organized in 1890, when a constitution was adopted. In 1901 it received a charter from Congress. In the United States, the local clubs are organized into state federations. The national convention is held biennially and there is a council which meets in the alternate years.

WOOD, LEONARD (1860–1927), an American soldier and administrator who was the originator of military camps for college students and citizens' training camps, such as that at Plattsburg, N. Y. He was born at Winchester, N. H., and educated at Pierce Academy, Middleboro, and Harvard University, where he was graduated in medicine in 1884. He joined the medical staff of the army, and in 1886, as assistant surgeon, he was the medical line officer in Captain (afterward Major-General) Lawton's campaign against the Apache Indians. In 1908 he received the Congressional Medal of Honor for distinguished services in that campaign. He was appointed assistant surgeon of the army in 1888, and in twelve years rose to the rank of major-general of volunteers.

At the outbreak of the Spanish-American War, General Wood (then Colonel) and Theodore Roosevelt organized the First Cavalry, known as the "Rough Riders." Wood was first and Roosevelt second in command of the regiment which is famous for its gallant charge at San Juan Hill.

General Wood was appointed governor-general of Cuba in 1899 and continued in the position until the United States retired from the island in 1902. He displayed rare tact and administrative ability, especially in improving the sanitary conditions of Santiago and Havana. Yellow fever, a former scourge of the island, has been practically unknown in Cuba since General Wood's administration. In 1903 he was placed in charge of a division of the army in the Philippines and in the same year was made a major-general in the regular army. In 1908 he was made chief of the Department of the East, with headquarters at New York. In 1910 he was special ambassador to Argentina, and the same year was appointed chief of staff, retaining the position until 1914, when he returned to the command of the Department of the East.

While he was chief of staff, General Wood inaugurated military training camps for college students and the citizens' training camps, which later were important agencies in training officers for the army. He has always been a strong advocate of military preparedness. When the United States entered the World War, General Wood was transferred to the Department of the South, with headquarters at Charleston, S. C. In April, 1918, he was assigned to the command of the 89th Division at Camp Funston, Kansas. The Washington administration did not permit him to take a command in France. From Camp Funston he was transferred to the Central Department, with headquarters at Chicago, in 1919. In 1920 he sought the Republican Presidential nomination, and in 1921 was appointed governor-general of the Philippine Islands by President Harding.

WOOD AL'COHOL, or METHYLATED ALCOHOL, a liquid having the appearance and many of the properties of pure alcohol. It is obtained from the destructive distillation of wood, and is used as a solvent for resin and varnishes and as a fuel in the same way as ordinary alcohol. It mixes with water in all proportions. A mixture of seventy-five per cent water and twenty-five per cent alcohol in an automobile radiator will prevent freezing at a temperature of five degrees above zero; a mixture of fifty per cent each will prevent freezing at twenty degrees below zero. Wood alcohol should never be used medicinally, either externally as a liniment or internally, as it is very poisonous, producing vertigo, coma, blindness and death.

WOOD'BINE. See HONEYSUCKLE.

WOOD CARVING, the art of producing sculpture in wood. Wood carving was probably the earliest form of sculpture. As far as known, the Egyptians were the first wood carvers. Specimens of their work, made more than 4000 B. C., are still in existence, and it is quite probable that the Greeks obtained their first ideas of sculpture from the wood carving of these people. The Romans also carved many of their early statues from wood. In the first century of the Christian era wood carving was used in the decoration of churches, and many pieces still in existence show the remarkable skill of the artists and workmen of that time. From the early centuries of the Christian Era wood carving fell into disuse, until about the eleventh century, when it was again revived, and used, as before, in the decoration of churches.

Wood carving as practiced to-day is confined to the ornamentation of altars, pulpits and choir stalls for churches; to a few articles of the most expensive furniture; to the decoration of expensive interiors of dwellings and public halls, and to ornaments. Among European nations the art is practiced with the greatest skill in Tyrol, Switzerland, and some of the provinces of Italy and Germany. Among the Eastern nations the Persians are remarkably skilful in carving wood. The work is finely executed, but shows a tendency to overcrowding, which mars the general effect. The Chinese and Japanese also produce wood carvings of decided merit.

All the finest work is done by hand, with small chisels, shaped for the purpose. Oak, mahogany, ebony and many of the softer woods are used. Before carving, the wood should be thoroughly seasoned. The completed work is usually finished by rubbing down in oil. In the United States but little hand carving is done, though in some manual training schools it is now a part of the course.

WOOD′CHUCK, the popular name of an animal of the squirrel family, common in the United States and Canada. The woodchuck is the American marmot and is often called the *ground hog*. It is of a heavy form, from fifteen to eighteen inches long, blackish or grizzled above and chestnut red below. It feeds on vegetables and is very destructive to crops of red clover and alfalfa. In the winter it hibernates in burrows. There is a popular superstition that the woodchuck first comes out on Candlemas Day (February 2); if it sees its shadow it returns to sleep, because it knows that six weeks of cold weather will follow.

WOOD′COCK, a bird belonging to the same family as the snipe, differing from the latter in having a more bulky body and shorter legs. It is widely distributed over North America, Europe, Northern Asia and Japan. It spends the summers in pine forests and the winters in southern swamps and moist woodlands, where worms, snails and slugs are plentiful. It is active by night but quiet during the day. The bird is about twelve inches long. The upper plumage is an intermingling of ruddy, yellowish, and ash, and is marked with black spots. Underneath, it is yellowish red with zigzag markings. The eyes are large and are set far back. The bill, nearly half the length of the body, is used with great skill in digging worms.

WOOD DISTILLATION, conversion of the volatile substances in wood to obtain charcoal, wood alcohol, acetic acid, acetone, creosote and wood turpentine. Coniferous as well as deciduous trees lend themselves to distillation. Wood turpentine is a by-product of the former, but the yield of acid is less than with hard woods. The still or retort into which the liquid is heated, the condenser which cools the vapors and the receiver which collects the distillate constitute the simplest distillation apparatus.

WOOD ENGRAVING. See ENGRAVING, subhead *Wood Engraving*.

WOODEN HORSE. See MYTHOLOGY, *The Trojan War*.

WOODMEN OF AMERICA, MODERN, a fraternal and insurance society founded in 1883 at Lyons, Iowa, and the following year chartered under the laws of Illinois. It is one of the largest fraternal benefit organizations in America, having a membership of more than a million. The head officer is known as head consul, and the various geographical divisions, of which there are more than 14,000, are called camps. Since its founding the order has paid out in death and benefit claims more than $500,000,000. One of the beneficial features of the society is a large and well-equipped tuberculosis sanatorium at Woodman, Colo.

WOODMEN OF THE WORLD, a fraternal and insurance order founded in 1890 at Omaha, Neb. The organization is divided geographically into three main camps, one of which is the Sovereign Camp of the World, whose executive committee is also the governing body of the entire order. The Woodman's Circle, an affiliated organization, of which Woodmen may become members, is controlled by a body called the Supreme Forest. Woodmen pay old-age benefits and erect monuments to deceased members. By levying a special assessment they were able to pay benefits in all cases of members killed in World War I. Since its founding the order has paid out in benefits more than $100,000,000. It has thousands of subordinate camps and a membership of approximately half a million.

WOOD′PECKER, the name of a large group of climbing birds, of which there are a number of different species. They have long, straight, angular beaks, adapted to perforating the bark of trees. Their tongues are long, slender and armed with a barbed,

YELLOW-BELLIED SAP SUCKER

horny tip. They can thrust their tongues far out of their mouths and so spear insects in the depths of their burrows. Their tongues are also covered with a sticky, slimy substance, that helps to hold their prey. When feeding, they usually ascend the tree spirally, aided by the spiny points which terminate their tail feathers. They tap here and there on the tree trunk, searching for the holes in which insects are hidden, and often tear away large parts of rotten trees, for the larvate concealed in them.

The *sap sucker* is a species that is fond of the sap of trees and bores round holes, which it arranges with geometrical exactness in broad bands around the trunk of a tree. It especially favors the pines, and in feeding it moves about over the checkerboard of holes, taking the sap from them regularly, as it accumulates. The *ivory-billed woodpecker* of the southern United States is a large bird, about twenty-one inches long, bright black and white in color, the male having a large bright scarlet crest. Like most of the other woodpeckers, this one excavates its nest in suitable dead trees. The *redheaded woodpecker,* the *black and white woodpecker*, the *hairy woodpecker* and the *downy woodpecker* are well known in the Northern states. The redheaded woodpecker often lights on the shingles of houses or on a hollow branch and strikes his bill in a noisy clatter, stopping now and then to call out his hoarse, rough note. The woodpeckers are found in almost every temperate part of the globe, except that none ever existed in Australia and Egypt. See FLICKER.

WOOD PE'WEE, a little bird of the flycatcher family, related to the phoebe. It is brown on the back and yellowish-white underneath; the quills are brown, with light edges. The spread of the wings is about twelve inches. The bird has a rapid flight and catches insects with skill. Its low, plaintive little note, *pee-a-wee,* may be heard in the woods, all through the long summer, at early dawn and during the twilight hours. The birds spend the summer in the United States and Canada, and in winter they migrate to South America. The nest is a wonderful structure of mud, grass and moss lined with down and other soft materials, and hangs bracketlike against a beam or tree. Two broods are raised annually in spring and autumn. See PHOEBE.

WOOD SPIRIT. See METHYLATED SPIRIT.

WOODSTOCK, ONT., the county town of Oxford County, is situated about midway between Detroit and Niagara Falls, on the Canadian Pacific and the Canadian National railways, and on a line of the latter which runs from Port Dover on Lake Erie to Owen Sound and other Georgian Bay ports. It is also connected with the Michigan Central and Wabash systems by a branch of the Canadian Pacific. The city is beautifully situated at the confluence of the Thames River and Cedar Creek. Its famous avenues of trees, general attractiveness and healthfulness make the city a favorite summer resort.

Woodstock is an important manufacturing and commercial center. The leading manufactures are furniture and farm machinery. The town is the center for a large farming and dairying region. It has excellent hotels, a collegiate institute and a Y. W. C. A. It is also the seat of Woodstock College. The town was named for Woodstock, England. Population, about 15,500.

WOOL AND WOOL'EN MANUFAC'TURE. Wool is the modified hair of sheep, several species of goats and certain members of the camel family. It is one of the principal fibers used in the manufacture of cloth and clothing. Woolens afford warmth without great weight, and are a protection against extreme heat as well as against cold. They are soft and flexible, and of them the most healthful clothing is made.

Structure and Grades. If we draw a fiber of wool through the fingers from tip to base it feels rough; if we draw it from base to tip, however, it is smooth and soft. An examination of wool through the microscope shows the reason for this difference. Wool fiber consists of minute scales or plates, which overlap like the scales on a fish. The difference in quality of the fiber is due to the difference of these scales in size and shape. It is the interlocking of these scales that causes wool to shrink.

Wool is graded as coarse, medium and fine, according to the length and size of the fiber. The finest sheep's wool is obtained from the Merino sheep and varieties that have been developed from this breed. The wool from which alpaca and mohair are made is that of the Cashmere goat, from which the soft, silken Persian shawls and rugs are made. Some wool resembles fur in fineness.

For purposes of manufacture, wool is divided into *carding wool,* which includes the short, curly fibers, and *combing wool,* which includes the long fibers. The coarsest of the long-fiber wools are known as *carpet* and *blanket wools.* The quality of wool varies in the same fleece, that on the shoulders and sides being the best and that on the back the poorest.

Production. The demand for wool has not decreased by reason of the introduction of substitutes. The cotton market has to meet the competition of rayon products; though some rayon has a cotton base, much of it is spun with wool. Though no competing textile challenges woolen cloth, in the manufacture of woolen goods there is frequently considerable adulteration; "all-wool" fabrics incline to be increasingly expensive, for not always is the supply in keeping with the demand.

The principal wool-producing countries are Argentina, Australia, the United States, India, China, Russia, South Africa, New Zealand, Uruguay and Great Britain. Canada is not a large world factor, for the Dominion has only about 3,700,000 sheep. The number of sheep in the United States averages approximately 50,000,000 from year to year, and the fleeces secured from them exceed 310,000,000 pounds. The entire wool production of the world is about 3,700,000,000 pounds a year.

Manufacture. The following are the chief processes employed in making woolen cloth:

When the wool is brought to the factory, it is carefully sorted, and that having the same grade of fiber is placed together. It is then thoroughly cleaned by being dusted, scoured with soap or lye and hot water, and then rinsed. After this, if colored cloth is to be made, the wool is dyed. It is then dried and is ready for the second important step in the process, that of preparing it for the loom.

The dried wool is first run through a machine which removes any burs that may have adhered to the fiber. It is then run through the *picker,* which pulls all the little tufts of wool apart and also enables the manufacturer to mix wools of different colors in any proportion desired. By mixing white and brown or blue and black or blue and gray, many very pleasing effects are obtained. After picking, the wool passes through the carding machines, of which there are usually three. Each of these draws out the fiber and straightens it and places the wool in the form of a loose band, or roll. Each successive machine straightens the fiber and reduces the sizes of this band, making it each time proportionately stronger. When the wool leaves the third card, it is in the form of a *sliver,* an untwisted yarn a little larger than the heavy crocheting yarn. As it comes from this machine it is wound upon large spools, or bobbins, and is ready for spinning.

The spinning is done on the mule jenny, and a large number of threads are spun at a time. The size of the thread and the hardness of the twist depend upon the way in which the machine is gauged. For a fine thread that is hard-twisted, a machine which revolves very rapidly and also draws the thread out rapidly, is necessary. The spun yarn is wound upon spools ready for being placed in the loom. The arrangement for this consists of frames upon which these spools are placed in such a position that the thread unwinds from them directly, to make the warp of the width and number of threads desired. The woven cloth is finished in the style selected, possibly re-dyed, then pressed and wound into bundles containing about fifty yards each, in which form it is placed upon the market.

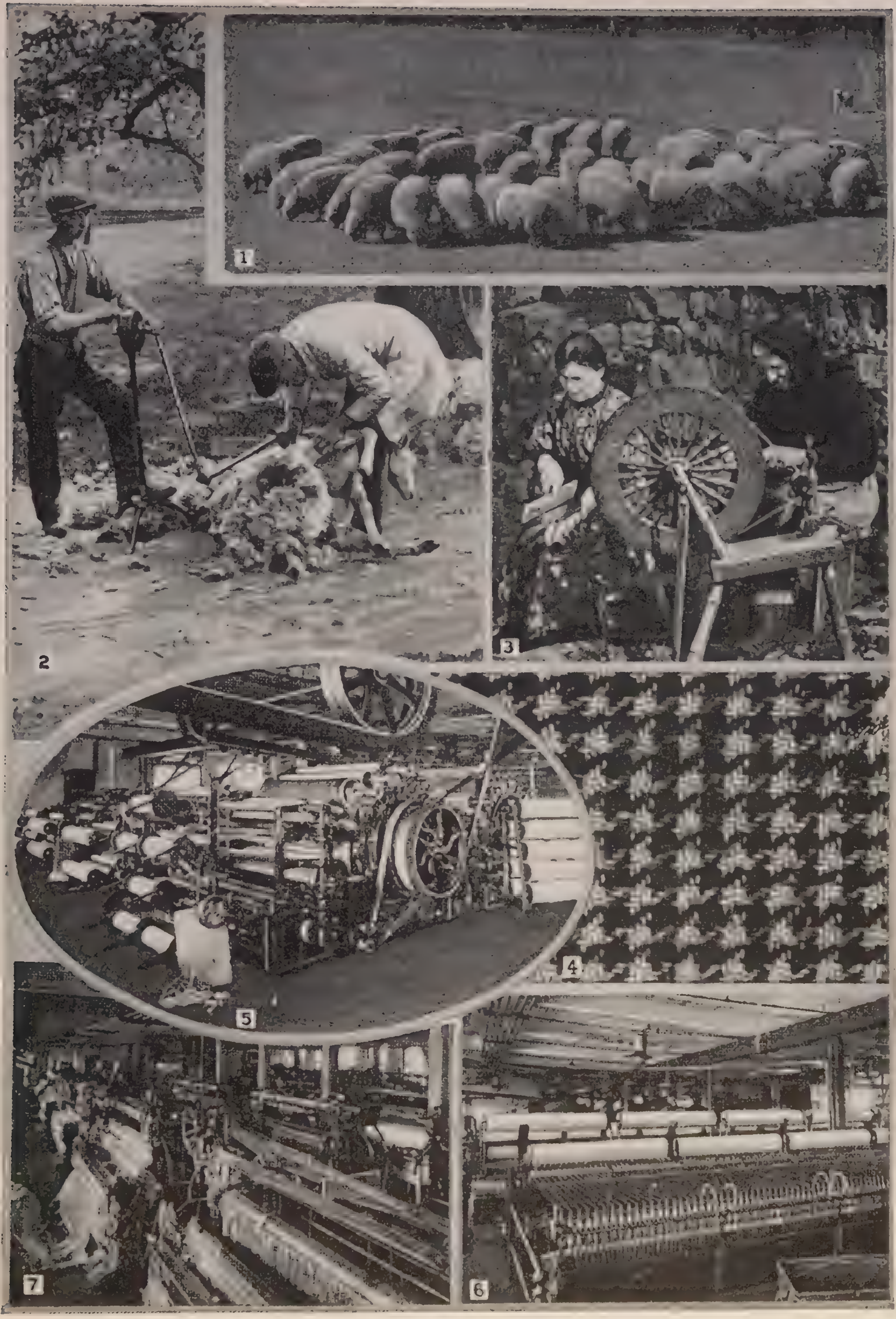
The manufacture of worsted is much like the production of woolens. Threads for woolen goods are carded, but the fibers are left mixed and matted so that the thread is irregular. Worsted thread is not only carded but it is combed as well. The fibers lie parallel to each other and the thread is regular with the short fibers removed. The thread also presents a brighter appearance, a distinct pattern and a smooth weave.

Styles in worsteds include cashmeres, voiles, all-wool serges, gabardines, and various materials for coats and suits.

Related Articles. Consult the following titles for additional information:

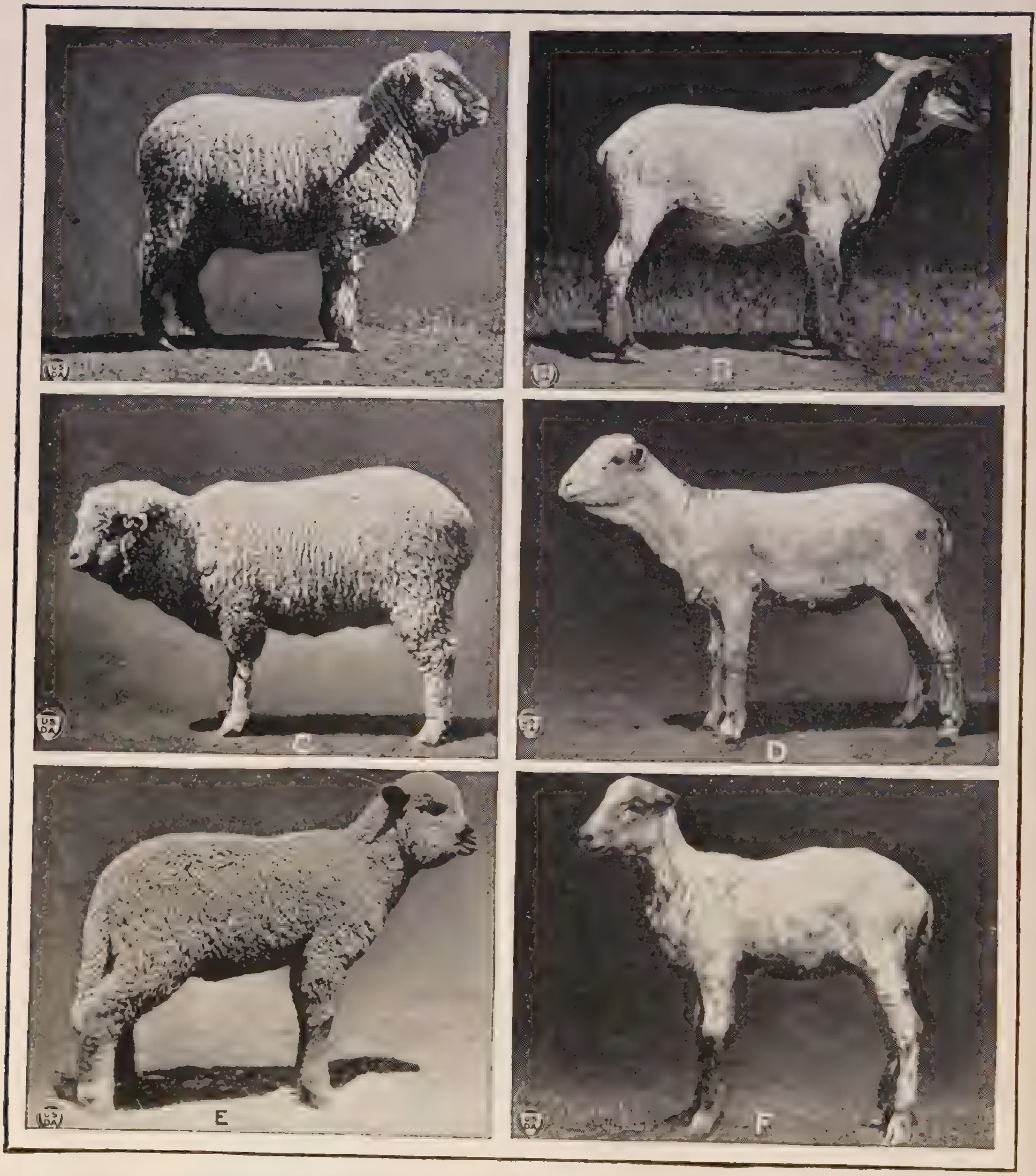
Alpaca
Cashmere Goat
Dyeing
Felt
Fiber
Flannel
Mohair
Sheep
Shoddy
Spinning
Teasel
Tweed
Weaving
Worsted

WOOLLCOTT, ALEXANDER (1887–1943), an American author and critic, born in New Jersey and educated at Hamilton College and Columbia University. He spent two years in France in World War I as an enlisted man and was one of the editors of *The Stars and Stripes.* Woollcott wrote several books, the most successful being *While Rome Burns* and the *Woollcott Readers.* Others are *Going to Pieces* and *Two Gentlemen and a Lady.*



FROM FLEECE TO FABRIC

(1) Sheep before shearing; (2) power-driven clippers removing the soft, heavy fleece; (3) carding wool, and spinning yarn to use in weaving homespun tweed (4); modern power machines for carding (5); (6) spinning machines; (7) power looms.



THREE MARKET GRADES OF LAMBS

Wool buyers do not trust appearances; they handle animals to discover their qualities. In the illustrations, A and B represent choice lambs, wooled and after shearing. C and D are examples of medium lambs, wooled and shorn. E and F exhibit the lowest grade, cull lambs, before and after shearing.

WOONSOCKET, R. I., in Providence County, fifteen miles northwest of Providence, on the Blackstone River and on the New York, New Haven & Hartford Railroad. With abundant water power from the Blackstone and its two tributaries, Woonsocket is a prominent textile community, ranking high in the production of fine woolens and worsteds. Machine tools and gauges, rubber goods and rayon yarns are also manufactured here. The place was settled about 1866 and was a part of Cumberland until 1867, when it was separately incorporated as a town. Several factory villages joined Woonsocket to form the present city, which was incorporated in 1888. Population, about 50,000.

WORCESTER, *woos' tur,* MASS., the second city in size in the state and one of the county seats of Worcester County, Fitchburg being the other. It is on Lake Quinsigamond, forty-four miles west of Boston, and on the New York Central, the Boston & Maine and the New York, New Haven & Hartford railroads. Worcester is one of the most important manufacturing centers of New England, producing abrasives, shoes and leather, chains, clothing, paper goods, food products, foundry and machine-shop products, machinery, tools, wire and textiles. The city is one of the largest producers of machine tools in the world. Six insurance companies have their home offices in Worcester.

In Worcester are a state teachers college for women and four colleges for men—Clark University, Worcester Polytechnic Institute, Holy Cross College and Assumption College. Other cultural centers are the art museum, the library of the American Antiquarian Society, the library and museum of the Historical Society and the museum of the Natural History Society. A music festival is held here annually. There is a state hospital for the insane in Worcester.

Worcester was first settled in 1673, but was abandoned on the outbreak of King Philip's War, two years later. A second attempt in 1684 was also given up because of Indian depredations, and the first permanent settlement was not made until 1713. In 1722 Worcester was incorporated as a town, and in 1848 was chartered as a city. Its development was stimulated by the completion in 1828 of the Blackstone Canal connecting it with Providence, R. I. Worcester is the birthplace of the historian George Bancroft, who was also Secretary of the Navy in President Polk's Cabinet. Many famous people have lived here; among these were Elias Howe, Eli Whitney, General Rufus Putnam, Dorothea Dix, Clara Barton and Edward Everett Hale. Population, about 203,000.

WORDSWORTH, *wurdz'wurth,* WILLIAM (1770–1850), an English poet, a leader in the Romantic movement which transformed English poetry early in the nineteenth century. Wordsworth, Coleridge and Southey were the founders of the so-called Lake School of poetry. Of these representative poets, Wordsworth had the most enduring influence (see LAKE SCHOOL). He was born at Cockermouth, Cumberland. After the death of his father, he was sent, at the age of eight, to Hawkshead grammar school. The natural surroundings of this place made a deep impression on young Wordsworth, and implanted in him that ardent love of nature which was so vital a part of his poetic genius. In 1787 he entered Cambridge University, graduating in 1791. Later in the same year he went to France. At first he felt the most ardent sympathy with the Revolution, but the excesses which developed out of it shocked him greatly, and as time went on he settled down to a staid conservatism. Shortly after his return from France, Wordsworth published his first poems, *An Evening Walk* and *Descriptive Sketches Taken during a Pedestrian Tour among the Alps.*

In 1795, Wordsworth, with his sister Dorothy, settled first at Racedown in Dorset, and then at Alfoxden, near Coleridge. Here the two poets held daily intercourse, and after a twelvemonth they published *Lyrical Ballads.* This volume contained as Wordsworth's contribution, among others, *We are Seven* and *Lines on Tintern Abbey.* Although the poems were received with almost complete public indifference, yet Wordsworth felt that he had found his mission, and after a winter spent in Germany, he and his sister settled at Grasmere. Incidents in his later life include his marriage, in 1802, with Mary Hutchison; his appointment, in 1813, to an inspectorship of stamps and his removal to Rydal Mount; several journeys into Scotland and to the continent; his acceptance of a D. C. L. degree from the University of Oxford in 1839, and his accession, in 1843, to the laureateship, on the death of Southey.

The public and the critics were slow to recognize Wordsworth's ability, refusing to accept his idea that poetry may deal with simple and natural subjects, presented in simple and natural language. Coleridge, Lamb, De Quincey, Southey, Keats and others were his admirers, however. His autobiographical *The Prelude,* which he himself described as tracing "the Growth of a Poet's Mind," was intended as the beginning of a long philosophical poem of which *The Excursion* and *The Recluse* (a fragment) were a part. His sympathy with nature and his belief in the brotherhood of man find expression in all of his poems. Among the most beautiful are *Tintern Abbey,* the *Ode on the Intimations of Immortality, Ode to Duty, The Solitary Reaper, To a Highland Girl, I Wandered Lonely as a Cloud* and *Yarrow Revisited.* His sonnets are among the finest produced in English.

WORK, a general term for effort expended toward a given end. It also implies motion against a resisting force, that certain results may be obtained. A man who lifts a weight, in labor or in play, performs work; the resisting force he encounters is the force of gravitation. The impulse which sends the electric current along a copper wire to light a room or run a motor performs work. The falling water which wears away solid rock performs work as surely as does that which falls over a water wheel and turns machinery. Work is accomplished whenever one body transfers its energy to another body.

WORKMEN'S COMPENSATION LAWS. See EMPLOYER'S LIABILITY.

WORLD COURT. See PERMANENT COURT OF INTERNATIONAL JUSTICE.

WORLD'S COLUMBIAN EXPOSITION, an international exposition of arts and industries, in commemoration of the four hundredth anniversary of the discovery of America by Columbus. It was built in Jackson Park, Chicago, on the shore of Lake Michigan, and was open from May 1 till November 1, 1893. The exhibition comprised over 400 buildings, covering fully 200 acres of ground.

The architectural beauty of the whole exposition was one of its greatest triumphs. The center of the main group of buildings was the Court of Honor, consisting of a wide plaza, with a lagoon in its center, having at one end a beautiful electric fountain, sculptured by MacMonnies, and at the other a graceful semicircular peristyle.

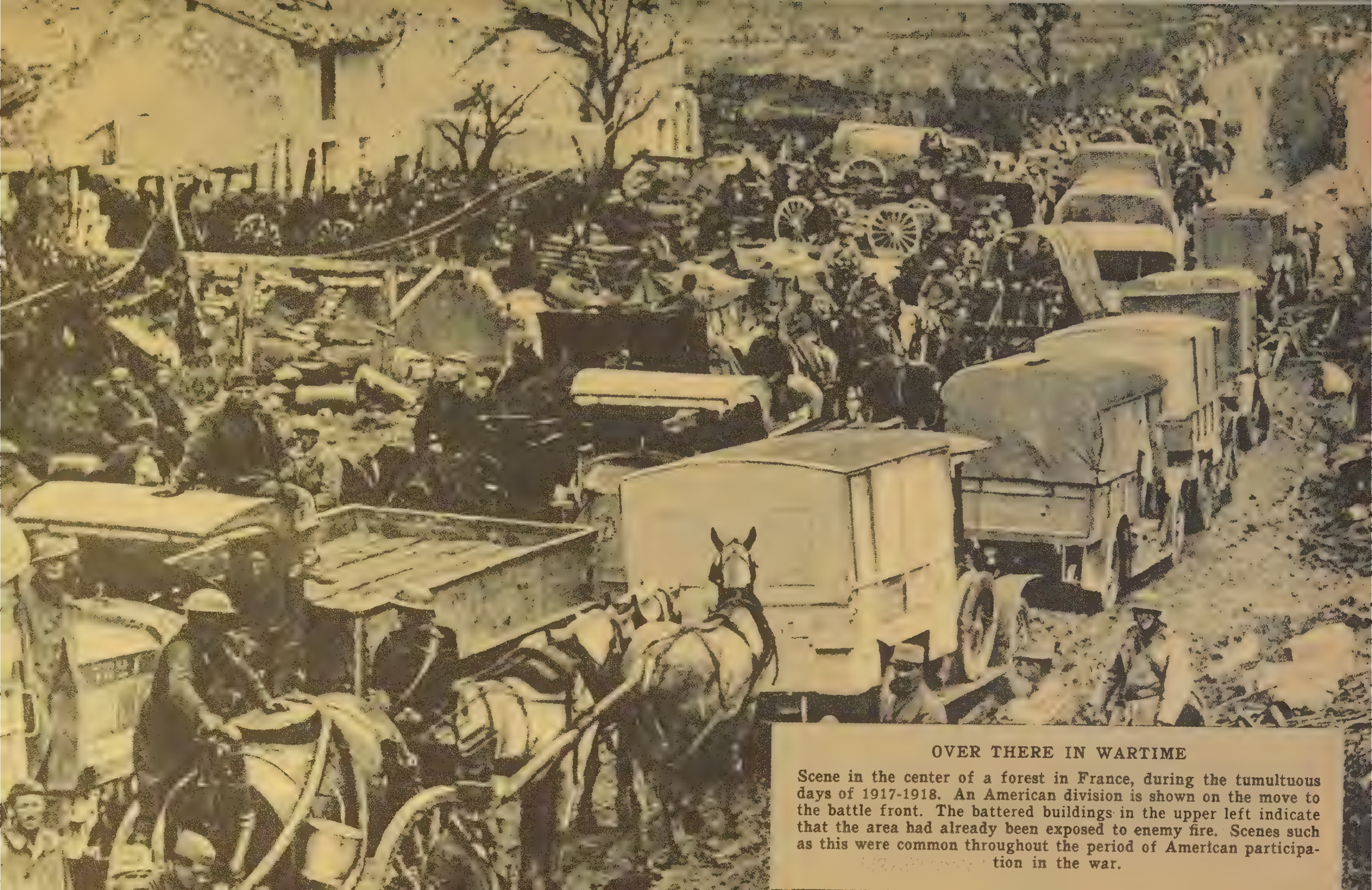
The attendance from the opening to the closing day was 27,539,041.

WORLD WAR, the name applied to each of two great wars, both of which involved nearly all the world. These wars, beginning in 1914 and in 1939, were not two separate conflicts, however, but divisions of the same war. The causes which created trouble in 1914 were still the underlying causes in 1939, and the unsolved problems of the first war aided in precipitating the second. The very treaty of peace which ended the First World War had in it the germs of dissension which demanded another (see VERSAILLES, TREATY OF). The First World War had no parallel in wars to that time, in number of nations involved, cost in men and money, and changes resulting from it, but the Second World War surpassed it.

Basic Causes. These wars had their origin in Central Europe, with its complex problems. Small nations set down in the midst of larger ones were confronted with the need for expansion and survival. Lack of raw materials, of trade routes and of foodstuffs produced friction. The small nations were subject to the control, direct or indirect, of the large ones. In almost all the nations there were minorities, small groups of people allied closely to their own native country and alien to the one where they lived. They wished to preserve their nationality and the country of their homes wished to absorb them. Thus, economic, racial and political problems led to the First World War.

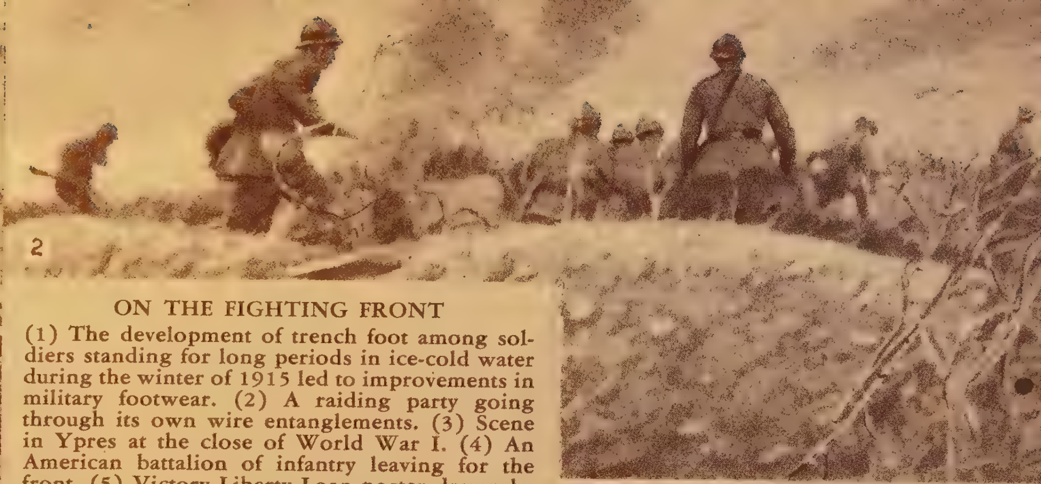
WORLD WAR I

Immediate Causes. Although a war had long been prophesied, and the eyes of the world had been turned particularly on Austria-Hungary and on the Balkans, "powder-keg of Europe," the actual beginning of the conflict came as a surprise. On June 28, 1914, Archduke Francis Ferdinand, heir apparent to the Austrian throne, and his wife were assassinated while visiting Sarajevo, capital of Bosnia. The assassin was Gavrilo Princip, a young man who was one of the principals in a scheme to incorporate Bosnia in a Greater Serbia. The Austrian government believed the assassination had been plotted in Belgrade, capital of Serbia, instead of among the Serbians of Bosnia. Austria presented heavy demands to Serbia, and expressed dissatisfaction with the reply. Consequently, Austria declared war on Serbia on July 28. That was the beginning.



OVER THERE IN WARTIME

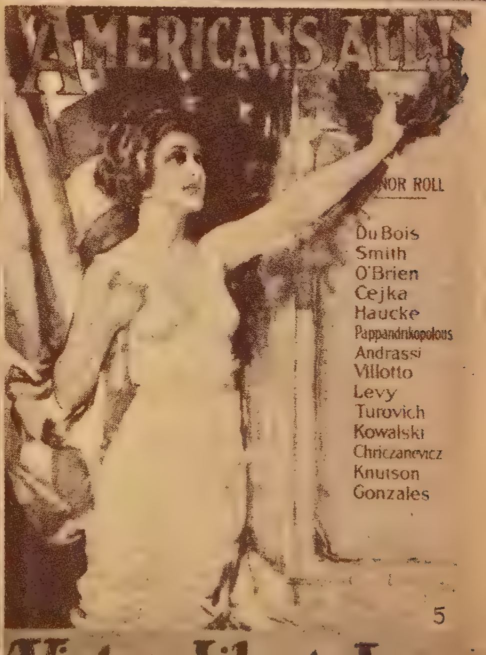
Scene in the center of a forest in France, during the tumultuous days of 1917-1918. An American division is shown on the move to the battle front. The battered buildings in the upper left indicate that the area had already been exposed to enemy fire. Scenes such as this were common throughout the period of American participation in the war.



2

ON THE FIGHTING FRONT

(1) The development of trench foot among soldiers standing for long periods in ice-cold water during the winter of 1915 led to improvements in military footwear. (2) A raiding party going through its own wire entanglements. (3) Scene in Ypres at the close of World War I. (4) An American battalion of infantry leaving for the front. (5) Victory Liberty Loan poster drawn by Howard Chandler Christy.



5

Germany supported Austria; Russia joined Serbia; France naturally supported Serbia, as France and Russia were allied. Great Britain entered the war because Germany refused to respect the neutrality of Belgium.

The list of war declarations for 1914 is as follows:

Austria-Hungary, on Serbia	July 28
Germany, on Russia	Aug. 1
Germany, on France	Aug. 3
Germany, on Belgium	Aug. 4
Great Britain, on Germany	Aug. 4
France, on Germany	Aug. 4
Austria-Hungary, on Russia	Aug. 6
Montenegro, on Austria-Hungary	Aug. 7
Montenegro, on Germany	Aug. 9
Serbia, on Germany	Aug. 9
France, on Austria-Hungary	Aug. 10
Great Britain, on Austria-Hungary	Aug. 12
Japan, on Germany	Aug. 23
Austria-Hungary, on Japan	Aug. 27
Austria-Hungary, on Belgium	Aug. 28
Russia, on Turkey	Nov. 3
France, on Turkey	Nov. 5
Great Britain, on Turkey	Nov. 5

Italy joined the Allies in 1915. War declarations for that year:

Italy, on Austria-Hungary	May 23
San Marino, on Austria-Hungary	June 2
Bulgaria, on Serbia	Oct. 13
Great Britain, on Bulgaria	Oct. 15
France, on Bulgaria	Oct. 16
Russia, on Bulgaria	Oct. 19
Italy, on Bulgaria	Oct. 19

In 1916, the following nations were added:

Germany, on Portugal	Mar. 8
Austria-Hungary, on Portugal	Mar. 15
Italy, on Germany	Aug. 27
Rumania, on Austria	Aug. 27
Germany, on Rumania	Aug. 28

And in 1917, headed by the Allied triumph of the entrance of the United States, the list was as follows:

United States, on Germany	Apr. 6
Cuba, on Germany	Apr. 8
Panama, on Germany	Apr. 9
Greece, on Germany	July 22
Siam, on Germany	July 22
Liberia, on Germany	Aug. 7
China, on Germany	Aug. 14
Brazil, on Germany	Oct. 26
United States, on Austria-Hungary	Dec. 7
Panama, on Austria-Hungary	Dec. 10

The following nations severed diplomatic relations with Germany:

Bolivia
Costa Rica
Ecuador
Guatemala
Haiti
Honduras
Nicaragua
Peru
Santo Domingo
Uruguay

Events of 1915. The war during this year was fought on two fronts: the western and the eastern. In 1914, during the early weeks of the conflict, Germany had violated the neutrality of Belgium, shelled its towns, and marched across it to France, succeeding in reaching within forty miles of Paris before being forced to retreat, after the first Battle of the Marne. The German troops entrenched themselves at the Aisne River. A deadlock of over two years resulted.

In the winter of 1914–15 there was little fighting and France and Britain were frantically trying to assemble war materials and machines. In April, the Germans used gas for the first time in the war, while endeavoring to reach Calais. The summer was a time of heavy fighting, always from trenches, which were dug in all across the northeast of France and western Belgium; trench warfare characterized World War I. On the eastern front, the Russians successfully held back Germany and Austria until lack of munitions brought disaster and they were forced to retreat. They did, however, clear the Turks from the Caucasus. An appeal to Britain resulted in the unsuccessful Dardanelles campaign, where Allied troops held a position on Gallipoli from April until the end of the year.

Events of 1916. The great event of 1916 on the western front was the Battle of Verdun, which was fought from February to September, with many bitter attacks and counterattacks. The Germans advanced only four miles in six months, and finally stopped attacking when within three miles of the main fortress. Meanwhile, the Allies began another conflict, the Battle of the Somme, which raged from July to the end of the year. Supplied with proper artillery, and with great guns capable of smashing trenchworks and outposts, the Allies used tanks for the first time and slowly but steadily pushed the Germans back in a disastrous campaign.

Russia, having reorganized and acquired more munitions during the winter, in June began a heavy offensive against the Austrians, driving them into the Carpathian Mountains, and occupying the Bukowina crownland. Italy, having joined the Allies, made a number of small attacks, aimed at Austria. After brief successes, Rumania was overrun by German and Bulgarian troops, and half the country, including the oil and wheat territories, fell into German hands. In Asia, the Russian victories in Armenia were about the only successes of the Allies. By the end of the year, however, the Allies had control of almost all German colonial territory.

British naval supremacy had early driven German commerce from the seas, and for the most part the main German fleets remained at their bases at Kiel and Wilhelmshaven, protected by mines and fortifications. However, several German cruisers, including the *Emden* and the *Königsberg,* did great damage to Allied shipping before they were destroyed. Important engagements were the defeat of the German Far East Squadron off the Falkland Islands in December; the sinking of three German cruisers and two destroyers off Helgoland in August; and the only battle of the war in which the main fleets of Germany and England participated. This was the Battle of Jutland, on May 31. It was apparently without decisive results, but the German fleet was actually near overwhelming defeat, being saved only by fog and skillful seamanship, and did not venture out again during the war.

Events of 1917. In this year, the collapse of Russia was offset by the entrance of the United States into the war. The Verdun campaign resulted in the withdrawal of the German forces early in the year to a strong defensive position which came to be known as the Hindenburg Line. In April, the Allies began a new offensive. Its spectacular feats included the capture of Vimy Ridge by the Canadians, and, in June, the taking of Ypres and the ending of the threat to Calais. A French drive on the Aisne, and fighting by the British in Flanders, in an attempt to drive the Germans from the Belgian coast, were other outstanding efforts.

In Russia, political upheaval reached a climax in March with the long-threatening revolution which broke out in Petrograd. The czar was forced to abdicate, a democratic provisional government was set up, and loyalty to the Allies declared. But the revolutionists could not hold the armies together as a fighting machine, and German propaganda further weakened morale. A reorganization of the government under Lenin and Trotsky resulted in a treaty with the Central Powers whereby Russia made a separate peace and withdrew from the war.

Rumania was forced to give up the struggle and make peace, because of Russia's collapse. These withdrawals gave the Central Powers valuable territory and economic and political concessions. Italy, after heartening advancement, was driven out of the territory occupied, and German armies entered and occupied some 1,000 square miles of Italian territory.

In Asia, there were Allied victories in Mesopotamia and Palestine. Greece entered the war in July, but it was the entrance of the United States that was important to Allied morale and military strength. This step was precipitated by the refusal of Germany to respect the rights of all nations on the high seas and the announcement of the intention to sink neutral and enemy vessels anywhere on the seas, without warning.

After severing diplomatic rights, arming merchant vessels and endeavoring peaceably to combat this menace, the United States declared war. Major-General John J. Pershing was put in command of the American Expeditionary Force, the first contingent of which reached French soil on June 27. Sixteen German and Austrian passenger ships, interned in American waters, were commandeered to add to the transport service. Training camps were set up and conscription was employed. The American Navy was sent to European waters.

Events of 1918. In March, the Germans began an offensive on a fifty-mile front in northeastern France. The British, pushed back twenty-five miles in places, made a stand and were the victims of a second offensive in late May, this time toward Paris. On June 1 the Germans were within forty-six miles of Paris, but their drive was slowed. United States forces proved effective in a notable battle at Belleau Wood. American Marines, in the second Battle of the Marne on July 21, threw back the Germans at Chateau Thierry. With the French they pushed their advantage until the Germans withdrew from the Marne. General Foch had been made supreme commander of the Allies in the critical month of March.

Slowly the defense became an offensive against the Germans, who were forced to withdraw steadily. Soissons, Cambrai, Saint Quentin and Lille again became French, and the Hindenburg Line was broken. The American First Army Corps, asked to drive the Germans from the southern end of the battle line, cleared the Saint Mihiel salient and began to drive the enemy from the hilly Argonne Forest. In Belgium, meanwhile, the Germans were being driven out.

In the Balkans, Bulgaria was forced to surrender to the Allies, clearing the way for freeing Serbia, Montenegro, and Rumania. Turkey was forced to yield. In October, Italy began a major offensive against Austria, which asked for an armistice on October 31. A political upheaval in Germany followed the capitulation of Bulgaria, and President Woodrow Wilson was asked to take steps toward peace. On November 11 the Armistice was signed, calling for German evacuation of occupied territory, release of Allied prisoners, and various other concessions.

Some Interesting Figures. America's part in World War I is summarized in the following statement, given out by the chief of the statistical branch of the General Staff:

Total armed force, including army, navy, and marine corps	4,800,000
Total men in the army	4,000,000
Men who went overseas	2,086,000
Men who fought in France	1,390,000
Total registered in draft	24,234,021
Total draft inductions	2,810,296

Cost of war to April 30, 1919, $21,850,000,000.
Battles fought by Americans, 13.
American deaths from battle wounds, 50,327.
Americans wounded, 234,300.
Total casualties in army, 318,135.

During the war, 8,538,315 men were killed and died from various causes. The figures for each of the belligerents are as follows:

Germany	1,773,700
Russia	1,700,000
France	1,357,800
Austria-Hungary	1,200,000
British Empire	908,371
Italy	650,000
Rumania	335,706
Turkey	325,000
United States	126,000
Bulgaria	87,500
Serbia and Montenegro	48,000
Belgium	13,716
Portugal	7,222

Related Articles. In addition to topics listed below, the reader is referred to articles on the various countries involved in the war.

STATESMEN AND RULERS

Albert I
Balfour, Arthur J.
Bernstorff, Count
Charles I
Clemenceau, Georges
Constantine I
Francis Joseph I
George V
George, David Lloyd
Grey, Edward, Sir
Nicholas II
Poincaré, Raymond
Venizelos, Eleutherios
Victor Emmanuel III
William II
Wilson, Woodrow

MILITARY AND NAVAL COMMANDERS

Beatty, David, Sir
Bullard, Robert L.
Foch, Ferdinand
French, John, Sir
Haig, Douglas, Sir
Hindenburg, Paul von
Jellicoe, John, Sir
Joffre, Joseph J.
Kitchener, Horatio H.
Liggett, Hunter
Moltke, Count von
Pétain, Henri
Pershing, John J.
Sims, William S.

WORLD WAR II

Immediate Causes. In addition to the causes listed at the beginning of this article, there were some which led directly to the opening of World War II. The treaty provisions had led to wide unrest in Germany, to the growth of the National Socialist party, and the dictatorship of Adolf Hitler. The terrible destruction of World War I had resulted in world-wide depression and unemployment, lowering of currency value, heavy taxation, and consequent economic upheaval and conflict. The dictator countries in particular began strict censorship of the press, radio, and public meetings, and by means of propaganda inculcated beliefs of racial and political superiority in the minds of the masses.

Germany was rearming. The League of Nations failed to protect Ethiopia when Mussolini seized it in 1935, just as it failed to stop Japanese aggression in China, the Italian conquest of Albania, and aid by Germany and Italy to General Franco in Spain.

Hitler's aggressions were opposed only with an appeasement policy, and there were many of them before an actual world war was under way. Briefly these include:

1936—remilitarization of the Rhineland
1938—annexation of Austria
1938—Sudetenland given Hitler by the Munich settlement
1939—dismemberment of Czechoslovakia
1939—annexation of Memel
1939—conquest of Poland, September 1 to 28; division between Germany and Russia

These years had been marked by the signing of various treaties of friendship and alliance among the European nations, all of which proved mere "scraps of paper" when their governments wished to ignore or repudiate them. Great Britain and France, having tried to stop Hitler from attacking Poland, declared war on Germany on September 3, two days after his armies crossed the Polish border.

First Year of War (September, 1939–September, 1940). Hitler's policy, pursued throughout the period of his successes, was to strike first at the weakest and nearest, then use all resources—food, materials, men, products—to strengthen Germany for the next blow. As fast as his armies advanced, the countries were systematically looted, their economic life reorganized, and supplies began to move toward Germany in a steady stream. His methods were as ruthless as his policy. He waged a blitzkrieg (lightning war), striking suddenly and overwhelmingly, sweeping the old life into a destruction as complete as if a hurricane had passed by, and moving on with as little warning and nearly as great rapidity. A new vocabulary came into being for this kind of warfare.

Hitler used armored columns at high speed, with air support by bombers and fighting planes. He used psychology and propaganda, and counted heavily on the element of surprise. Old methods of warfare—the trench, the long orderly battle lines—were obliterated. Thus he swept into Poland, destroying as he went, and in twenty-eight days had conquered the country. He divided it with Russia and began exploitation of its peoples and products.

Russo-Finnish War. On November 30, Russia, emboldened by success in Poland, attacked Finland. Pacts of "mutual assistance" had been offered the Baltic states, giving Russia strong bases within their territories. All accepted but Finland; that small country's refusal precipitated war. In the following March, Finland signed disastrous peace terms, yielding the Karelian isthmus, the Mannerheim Line, the western and northern shores of Lake Ladoga, together with border territory north of the lake; islands in the Gulf of Finland, about half of the Petsamo region, and a thirty-year lease of Hangö Peninsula for a Russian naval base.

Invasion of the West. During the winter, a "sitzkrieg" occupied German troops, waiting behind their heavily fortified Westwall or Siegfried Line, and the French and British, facing them behind the Maginot Line, believed equally impregnable. But in April, 1940, suddenly the Germans occupied Denmark, too small to resist, and invaded Norway to break the blockade. They overcame Norwegian and British resistance, and in Norway set up a puppet government under Major Vidkun Quisling.

In May, Nazi troops, ignoring the Maginot Line with its bristling armaments, drove around it to the north. The Low Countries were invaded on May 10. Dutch water defenses and munitions were almost useless, and the country was taken, Queen Wilhelmina barely escaping capture. Rotterdam was bombed; as a lesson to the Allies, the heart of the city was systematically destroyed. On May 14, the Netherlands armies ended their resistance. Luxemburg was overrun in a single day. The Battle of the Meuse was a German victory, and Nazi troops hurried on toward the English Channel and France. King Leopold of Belgium, his troops trapped in a pocket, without hope of badly needed supplies and reinforcements, capitulated on May 28. Belgium was occupied, and King Leopold was imprisoned in one of his royal castles.

British and French troops, cut off from the Belgians, were driven back to the port of Dunkirk. There, while a delaying and protective action was fought, nearly 350,000 soldiers were rescued in a fleet made up of ferryboats, yachts, fishing vessels, and almost anything that the British could float, brought across the Channel largely by civilians. Tanks, guns, vehicles, even small weapons, and all supplies were lost.

The Fall of France. On June 10, with German success assured, Italy declared war on the Allies. Four days later Paris was occupied peaceably, and on June 17 aged Marshal Henri Philippe Pétain became Premier of France and asked for an armistice. The fall of France came only forty-two days after the beginning of the western campaign. Never before had any military action conquered so much in so little time. Germany on June 22 controlled countries from the North Cape to the North African possessions of Italy, its ally. Great Britain alone faced the Nazi lightning war machine.

Second Year of War (September, 1940–September, 1941). *Battle of Britain.* Hitler began the second year of the war with a great aerial bombardment of Great Britain, concentrating on London and on coastal and industrial cities. The attacks were most devastating in the opening month of September, 1940, but they were almost continuous for eight months, during which nearly 45,000 Britons lost their lives and one out of every five British homes was destroyed or damaged. Many British factories, wrecked in this furious bombardment, were rebuilt, some in other parts of the country, some underground.

Hitler further attempted to demoralize England and prepare for invasion by gathering transports and munitions along the European coast, setting up long-range heavy guns along the Channel to bombard the English coast, and intensifying submarine attacks on British shipping to destroy supplies of food, raw materials, and munitions. The British, however, never faltered in morale, and rallied their forces to meet the new menace.

Personalities in World War II

Belgium

Leopold III, King of the Belgians, whose unconditional surrender to the Germans on May 28, 1940, occasioned the dramatic evacuation of the British at Dunkirk.

Canada

King, William Lyon MacKenzie—Canadian Prime Minister during the war years. He co-operated with the United States in plans for the defense of the two countries.

McNaughton, Lieut. Gen. Andrew George Latta—Commander of the Canadian active service forces (1939-1943); he became Minister of National Defense in 1944.

China

Chiang Kai-shek, Generalissimo—President of the Chinese republic, and commander of all military forces in China's eight-year struggle with Japan.

France

Gaulle, Gen. Charles de—Leader of the Fighting French forces after the fall of France in 1940, head of the French regime set up in North Africa in 1941, and President of the French Provisional Government from November, 1945, to January, 1946.

Laval, Pierre—For his collaboration with the Germans as a member of the Vichy Cabinet, he was condemned as a war criminal, and shot by a firing squad in October, 1945.

Pétain, Henri Philippe—Vichy Chief of State after the fall of France in 1940. Convicted by a French court on Aug. 14, 1945, of intelligence with the enemy, his death sentence was later commuted to life imprisonment by De Gaulle.

Germany

Goebbels, Josef—Nazi propaganda chief, who committed suicide in the Reichschancellory in Berlin before the arrival of the Russians in April, 1945.

Goering, Hermann Wilhelm—Reichmarshal and Minister for Aviation in the Nazi regime; condemned to death as a war criminal in September, 1946, he committed suicide in the Nuremberg prison before the sentence could be carried out.

Hess, Rudolf Walther—Hitler's personal secretary and deputy until his mission to Scotland in 1941. In 1946, he was sentenced to life imprisonment as a war criminal.

Himmler, Heinrich—Head of the German state police (the Gestapo). He committed suicide after his capture by the British in May, 1945.

Hitler, Adolf—Nazi dictator, the Fuehrer (leader) of the Third Reich, supposed to have committed suicide in the Chancellory on April 29, 1945.

Ribbentrop, Joachim von—Nazi Foreign Minister, who negotiated the anti-aggression pact with Russia (1939) and the three-power treaty with Italy and Japan (1940). He was convicted as a war criminal and executed at Nuremberg in September, 1946.

Rommel, Field Marshal Erwin—Commander of the German Afrika Korps in the African campaign; head of the German armies in France that failed to stop the Allied Normandy invasion on June 6, 1944. He died in France in October, 1944.

Rundstedt, Field Marshal Karl Rudolf Gerd von—Military commander of occupied France after the scuttling of the French fleet in 1942; supreme commander of German forces on the western front during the Allied drive on Germany.

Great Britain

Alexander, Field Marshal Sir Harold Rupert Leofric George—Commander of the first British Expeditionary Force in France and of its evacuation at Dunkirk, field commander of the victorious Allied armies in North Africa and commander of the Allied armies in Italy. He was appointed Governor-General of Canada in 1945.

Chamberlain, Arthur Neville—As British Prime Minister in 1938, agreed at Munich to the partition of Czechoslovakia to secure "peace in our time."

Churchill, Winston Leonard Spencer—Prime Minister of the British coalition cabinet from 1940 to 1945. He succeeded Chamberlain in office.

Montgomery, Field Marshal Sir Bernard Law—Commander of the British Eighth Army in the Africa campaign and after August, 1944, commander of the Twenty-first Army Group in Europe, which fought in the Netherlands, northern Germany and Denmark in the closing days of World War II. "Monty" became chief of the British occupation forces in Germany after the surrender.

Mountbatten, Admiral Lord Louis—Head of the British Commandos and later the commander in chief of the Southeast Asia Command. He directed the successful Allied operations in Burma in 1944-1945.

Italy

Badoglio, Pietro—Commander of the Italian armies from Mussolini's declaration of war in June, 1940, until his resignation in December, 1941. In 1943, he succeeded Mussolini as Premier and surrendered to Gen. Eisenhower.

Mussolini, Benito—For twenty years Premier and Fascist dictator of Italy; he was ousted in July, 1943, and executed by Italian partisans in northern Italy in April, 1945.

Japan

Hirohito—Emperor of Japan. On December 7, 1941, he proclaimed that Japan was at war with the United States and Great Britain. After the Japanese surrender, he retained his throne subject to the authority of the Supreme Allied Commander.

Tojo, Hideki—Premier of Japan during the war years, and the war lord responsible for the attack on Pearl Harbor.

Yamashita, Lt. Gen. Tomoyuki—Commander of the Japanese forces that captured Singapore, Bataan and Corregidor in 1942, but were defeated in the Philippines in 1945. The "Tiger of Malaya" was hanged as a war criminal in February, 1946.

Norway

Quisling, Vidkun Abraham—Norwegian Fascist leader, whose betrayal of his country to the Nazi invaders made his name synonymous with traitor. He was executed as a war criminal in October, 1945.

Russia

Molotov, Vyacheslav Mikhailovich—As Soviet Foreign Minister, he signed the Nazi-Soviet non-aggression pact in 1939, the British-Russian mutual-aid agreement in 1941 and the United Nations Charter in 1945.

Stalin, Marshal Joseph Vissarionovich—Premier of the U.S.S.R. He was made Field Marshal in 1943.

Zhukov, Marshal Georgi Konstantinovich—Commander of the Russian forces that captured Berlin on May 2, 1945, and commander of the Russian occupation forces in defeated Germany.

United States

Bradley, Gen. Omar Nelson—Commanding general of the United States ground forces in the invasion of Europe, 1944, and head of the United States Twelfth Army Group in the European campaign.

Chennault, Maj. Gen. Claire Lee—Aviation adviser to China; founder of the American volunteer group of aviators in China, the "Flying Tigers"; commander of the United States Fourteenth Air Force, 1942-1945.

Clark, Lt. Gen. Mark Wayne—Commander in chief of the Allied forces in Italy, and commander of American occupation forces in Austria.

Doolittle, Lt. Gen. James—Leader of the spectacular daylight airraid over Tokyo on April 18, 1942, by carrier-based B-25 bombers; after 1943, commander of the Eighth United States Air Force.

Eisenhower, General of the Army Dwight David—Commander of the United States forces that landed in North Africa in 1942, and later commander in chief of all Allied forces there; commander in chief of Allied invasion armies in Europe, and United States representative in the Allied military government of the Reich until he succeeded General Marshall as Chief of Staff in 1946.

Halsey, Adm. William Frederick, Jr.—Commander of the United States Third Fleet in the Pacific under Adm. Nimitz, and the victor in numerous naval engagements with the Japanese. He led the U.S.S. *Missouri* into Tokyo Bay for the surrender ceremonies on Sept. 2, 1945.

Hull, Cordell—Secretary of State during the war years. He conferred with the Japanese peace envoys prior to the Pearl Harbor attack on December 7, 1941, and in 1944 invited the governments of Great Britain, Russia and China to meet in Washington for the discussions which led to the establishment of the United Nations.

MacArthur, General of the Army Douglas—Commander of United States army forces in the Pacific and, after the defeat of Japan, the supreme commander of Allied occupation forces for Japan. He was commander of United States forces in the Far East at the time of his heroic stand on Bataan Peninsula (1941-1942).

Marshall, General of the Army George Catlett—Chief of Staff of the United States Army during World War II.

Nimitz, Admiral of the Navy Chester William—Commander in chief of the Pacific fleet, 1941-1945; he became chief of naval operations in 1945.

Patton, Gen. George Smith, Jr.—Colorful commander of the United States Third Army in the drive on Germany. He was an expert on mechanized warfare.

Roosevelt, Franklin Delano—President of the United States; he died on the eve of victory in Europe, at the start of his fourth term in office.

Stilwell, Gen. Joseph W.—United States commander in the China-India-Burma theater until October, 1944, and commander of the United States Tenth Army in the closing months of the war with Japan. The Ledo Road, the new supply route from India to China, was renamed in his honor.

Wainwright, Gen. Jonathan Mayhew—Second in command in the Philippines in December, 1941; assumed full command when Gen. MacArthur was sent to Australia; a prisoner of the Japanese from May, 1942, to August, 1945.

Yugoslavia

Mikhailovic, Gen. Draja—Leader of the Chetniks who carried on guerrilla warfare with the Germans after the Nazi occupation of Yugoslavia in 1941. He later lost popular and international support to the Partisans, and in 1946 was executed for treason.

Tito, Marshal (Josip Brozovich)—Leader of the Partisans who won Allied support during World War II, and head of the Liberation Front party which after the war declared Yugoslavia a republic.

Invasion of the Balkans. Great Britain was occupied with home defense and recovery and with the North African campaign, which had now entered on its great period of seesawing back and forth with attack and counterattack, now one side gaining and now another. Germany, seeing the way clear, concentrated on the Balkans, filtering in troops and supplies, working through propaganda and political pressure. In October, German troops entered Rumania "to protect the oil fields." In March, 1941, Bulgaria signed the Berlin-Rome-Tokyo pact and German troops used the country as a corridor to Greece.

Yugoslavia was forced to sign the Tripartite Pact and permit German troops to pass through the country, but a revolutionary government repudiated this action. Hitler used the internal dissension as an excuse to attack Belgrade. Nazi divisions then poured into the country, which faced unconditional surrender on April 18, after twelve days of lightning warfare. Many Yugoslav soldiers escaped to their mountain homes and organized a guerrilla army which Hitler was never able to conquer.

Greece and the Middle East. Mussolini had attacked Greece in October, but the Greeks, aided by the British, had driven back the Italian forces into Albania. Now Hitler sent troops to Albania, driving the Greeks into their own country, and then conquering and looting it. Greeks and British withdrew into Crete, from which some were evacuated. King George escaped to England.

Hitler's designs on the Middle East were thwarted, however, as Turkey maintained neutrality and the British put down a revolt in Iraq and drove out Nazi agents. The rich oil fields remained in British control, accessible through Palestine. The Free French and the British forced Syria to yield to the Allies. Meanwhile, British troops had been slowly conquering Ethiopia, and in May, 1941, with British protection, Emperor Haile Selassie returned to his throne.

Russia Attacked. On June 22, German armies which had been massing for weeks on the Russian border suddenly crossed the line into Russia and attacked their ally. The mechanized forces rapidly regained all the Polish territory Russia had taken in 1939, and advanced steadily until the Russians were able to make a strong stand at the Stalin Line, and in little more than a month to slow down the Nazis. The battle line stretched from the Gulf of Finland to the Black Sea. The Germans were aided by the Finns, who were trying to regain what they had ceded to Russia in the preceding year, and also by soldiers of occupied countries, forced to fight.

War on the Sea. During this year of the war, at last the German submarine menace was lessened. From a peak of concentrated submarine attacks during the springtime, the turn came in midsummer, after which British submarine losses were cut rapidly to only one fourth of what they had been. The most striking naval event was the sinking of the German battleship *Bismarck* in May by the British in retaliation for the destruction of the *Hood.*

Third Year of the War (September, 1941–September, 1942). The outstanding happening of 1941 was the United States' entry into the war. In his message to Congress in January, the President had outlined the four freedoms of postwar necessity: freedom of speech and of worship, freedom from want and from fear. The Lend-Lease Act resulted, allowing the United States to lend supplies and materials of all kinds to nations in need. New defense bases were established, especially in Greenland, Iceland, Dutch Guiana, and, early in 1942, in Northern Ireland.

Meanwhile, peacetime service had been extended by eighteen months under the conscription law, and large sums had been voted for civilian defense. From May 21 to October 30, 1941, a dozen or more United States merchant and naval vessels were fired on, and some of them sunk, by German submarines. In November, the Neutrality Act was revised to permit the arming of merchant vessels and their sailing through combat zones to belligerent ports.

Japanese Attack on the United States. The situation between the United States and Japan became increasingly tense during the summer. As Japan showed growing military ambitions in the Pacific and against China, the United States stopped the sale of oil to Japan, virtually ending commerce. Britain also ended trade. However, even while Japanese representatives were negotiating for peace at Washington, D. C., on December 7, 1941, the United States naval base at Pearl Harbor, Hawaii, was suddenly attacked by Japanese planes and midget submarines. At Hickam Field, many American planes were destroyed on the ground and the hangars were badly wrecked. The United States Pacific

Fleet was in the harbor at the time; the battleship *Arizona,* three destroyers, a target ship, and a minelayer were sent to the bottom, and many ships were badly damaged.

On the following day, the Philippines were bombed, and the greater part of the airplanes defending the islands were destroyed. Guam was captured; Wake Island, after a heroic defense by only 378 Marines and a dozen planes, was taken on the day before Christmas. Three days later, General Douglas MacArthur withdrew his forces from Manila to save the capital, declaring it an open city. It was bombed by the Japanese, regardless.

President Roosevelt's request of a declaration of war against Japan was granted immediately by Congress, and on the same day Prime Minister Winston Churchill announced Britain's declaration. Hitler and Mussolini declared war on the United States within a few days, and Congress replied in kind. On January 2, 1942, in Washington, D. C., twenty-six United Nations (increased during the following years) pledged co-operation.

Japanese Conquests. By early February the Japanese occupied Manila, Hong Kong (surrendered on Christmas Day because of lack of water), and the entire Malay Peninsula. On February 15 Great Britain's "impregnable" naval base, Singapore, was in Japanese hands. Japanese bases were established in the Netherlands Indies and, with their rich supplies of oil, minerals, foodstuffs, and rubber, they were brought under control of the Rising Sun.

The British were driven out of Burma; the Burma Road, lifeline of supplies to China, was cut, and inroads were made into China itself. Japanese in Burma and China were greatly harried by the "Flying Tigers," American volunteer group. Outstanding was the heroic 140-mile march to safety through Burma jungles made by Lieutenant General Joseph W. Stilwell and a group of soldiers, nurses, and refugees.

In the Philippines, General MacArthur had withdrawn to Bataan Peninsula and fought bitterly until ordered by President Roosevelt to go to Australia to command the forces in the Southwest Pacific. General Jonathan Wainwright took over the Philippine command and, with American and Filipino troops, fought a heroic but losing battle against disease, starvation, and merciless bombing. He was forced to retire from Bataan to the rocky island fortress of Corregidor, and there, on May 7, he surrendered to overwhelming odds. In the meantime, the United States Pacific Fleet bombed Japanese forces on the Gilbert and Marshall islands, and on Wake and Marcus, the beginning of a stepped-up campaign of pounding from the air at Japanese Pacific strongholds. A surprise raid on Tokyo by General James Doolittle on April 18 greatly lowered the morale of the Japanese and bolstered that of China.

Pacific battles during the year included the Battle of the Coral Sea in May, in which a great Japanese fleet was defeated with enormous losses; and the Battle of Midway Island, in which neither fleet saw the other, the fighting being done by carrier-based planes. This was a United States victory.

New Guinea, strategic island in the Southwest Pacific, was greatly desired by the Japanese. From Salamaua, Lae, and Buna, where they had established bases, they crossed the high Owen Stanley Mountains in early summer, but were driven back by Australians under General MacArthur when within thirty miles of the Allied base at Port Moresby.

Other Events. Russia, with great losses of territory, foodstuffs, industrial areas, raw materials, and manpower, had fought desperately and continuously through winter and spring, occupying heavy German forces. On June 28, Hitler started a summer offensive, which the Russians resisted with a policy of keeping vital points, delaying German advance, and yet preserving their armies intact.

In Africa, the Libyan seesaw continued. On January 22 General Rommel drove the British four hundred miles from El Agheila toward Egypt. The British Eighth Army, however, early in July made a determined stand at El Alamein, within seventy-five miles of Alexandria.

Fourth Year of the War (September, 1942–September, 1943). The big event of this year of the war was the Allied invasion of North Africa. Eight hundred British and American ships formed the greatest invasion fleet the world had ever known. On November 8, 1942, just six days after General Bernard Montgomery and his Eighth Army had broken the German line at El Alamein, the Allies landed in North Africa. This was the beginning of a gigantic pincers movement which, by the end of six months, had driven Germans and Italians from east and west into the pocket of Tunisia and destroyed or captured them. This Battle of North Africa cost 300,000 Axis lives. It cleared the Mediterranean Sea, thus opening the way for invasion of Italy and of France, and afforded bases for air attacks on Europe.

As a result, on the night of July 9, 1943, the greatest amphibious force ever before collected approached Sicily, and landed on the south shore. By August 17, Sicily had been conquered through co-operation of British and American forces.

Meanwhile, the Russians had begun a powerful counteroffensive on November 19, 1942, above Stalingrad and followed with drives all along a front from Leningrad to the Caucasus. Steady advance was made during the winter. In July, the Germans started a heavy offensive but the Russians were ready in overwhelming force and steadily drove back the Germans. Stalingrad had been under siege from September 11 to February 2, but it was not taken.

Fifth Year of the War (September, 1943-September, 1944). The great event of this year was the successful invasion of Europe. On September 3, 1943, Britishers who had fought in North Africa landed on the toe of Italy, closely followed by American troops. On September 8 the Italian Army was officially surrendered and the surrender of the fleet followed. Nazi and Fascist troops fought on, however, and the Italian campaign settled down to a long and bitter struggle. Naples was taken on October 2, but Rome was not freed until June 4, 1944, and September saw the battle lines still stretched across the European boot. Among the most difficult battles were those for Cassino, a German stronghold centering around an old monastery, and the Anzio beachhead.

The most important invasion of Europe began on June 6, "D-Day," when the Allies landed in Normandy. Thousands of ships and airplanes made up the greatest force that had ever crossed the waters. Temporary harbors were built, breakwaters erected, and, protected by heavy bombing from the air and the sea, wave after wave of American, British, and Canadian soldiers went ashore.

The strategy of the invasion called for a drive with several prongs; the armies would take certain key points and by-pass all others, in order to progress rapidly across France. Cherbourg was taken on June 27 and St. Lō in July. Paris was freed on August 25. Meanwhile, by mid-August, American troops had accomplished a second landing in southern France. French forces joined them. They freed southern France by September.

Germany, in retaliation for the invasions, launched a ferocious robot bomb (V-1) attack on southern England, and followed it with a terrible rocket bomb (V-2) attack. These weapons killed and maimed thousands of men, women, and children before the Allies were able to capture the launching sites.

The Russians had been smashing forward, in late 1943 recapturing vital Smolensk and Kiev, and by the end of the year had freed 350,000 square miles of their Nazi-held territory. On January 4, 1944, Russian troops crossed into Poland, and also started a drive against the Baltic States. By April, they entered Rumania. Early in May they freed Sevastopol and regained the Crimea. In the summer they progressed steadily through Poland.

War in the Pacific had become increasingly important. In February, 1944, the Allies started their leap frog tactics to reach Tokyo —hopping from one Japan-held island to another. The Marshalls were first taken, then the Admiralties. In July, Japan suffered a major defeat to its navy in the Battle of the Philippine Sea. Saipan and Tinian had been taken by United States troops by September. Guam, the first American territory lost in the war, was also regained.

Much of the success of this year was due to the air supremacy of the Allies. Heavy bombers were sent in mass flights to cripple and destroy industrial areas of Germany. The coast of France was "softened" for invasion by bombing from the air, as were various Pacific islands. Aircraft carriers proved invaluable for attack in Pacific warfare.

The Sixth Year of the War (September, 1944–September, 1945). This year saw the beginning of the end. Definitely, on all fronts, the Axis was beaten back. The war in Europe was ended before the year was two thirds gone. In the Pacific, Japan had been driven from island after island until American planes were based within easy-reaching distance of the Empire of the Rising Sun and the home of the Sun of Heaven.

In Italy, Pisa was taken by the Allies on September 2, and the battle for the Gothic Line developed rapidly until it extended across the peninsula. By the end of the month, the Allies were in the valley of the Po. The Germans fought stubbornly, and, while Allied gains were steady, they were also slow and

SCENES FROM WORLD WAR II

Above: In June, 1940, Nazi soldiers rode in triumph through the streets of Paris. Upper right: View of Pearl Harbor on December 7, 1941, following the surprise Japanese attack. Right: Ruins on the beachhead at Anzio, Italy, in January, 1944. Below: Bridge at Remagen, where, in March, 1945, American forces made the first crossing to the east bank of the Rhine. Below right: A robot bomb (V-I) that fell short near Pas de Calais. Bottom left: The Red Flag raised over Sevastopol, liberated in May, 1944. Bottom center: Hitler and his Nazi leaders survey the ravages of war in Germany. Bottom right: Three years and 69 days after Pearl Harbor, the Stars and Stripes were raised above Mount Suribachi on Iwo Jima, 750 miles from Tokyo.

Photos: International; Acme

few until after mid-April, 1945, when an all-out offensive got under way. As the Allies advanced in northern Italy, Mussolini, German-controlled head of the puppet Fascist state, fled toward Switzerland. He was captured by Partisans, who tried him and executed him on April 28. On May 2, the Fascist Army and all German forces in Italy and western Austria surrendered unconditionally.

In the Pacific, the Palau Islands were taken in September, 1944, Peleliu being one of the most bitterly contested. In October, General MacArthur fulfilled the promise he made as he left the Philippines, "I shall return." He landed troops on Leyte, and set up bases from which to bomb military objectives and move on to take other key islands in a carefully planned campaign. It was not until the day after Christmas that he could announce the conquest of Leyte as completed.

In the meantime, Samar and Mindoro had also been invaded. On January 3, 1945, Marinduque was taken, and six days later, American troops landed on all-important Luzon. During the month there was steady progress, and on February 3 Manila was entered. Badly damaged by fires set by the retreating Japs, the capital city fell on February 6. Capture of such historic spots as Bataan and Corregidor, and the freeing of hundreds of civilian and military prisoners, many of them Americans, were highlights in the campaign.

In February, also, the Stars and Stripes were planted on Mt. Suribachi, highest point on Iwo Jima, one of the most bitterly contested islands of the war. In April, troops landed on Okinawa in the Ryukyus and further advanced the struggle for the islands guarding the homeland of Japan. Possession of the Pacific islands made it possible for aircraft carriers to come safely nearer targets in Japan itself. Tokyo, bombed heavily in the fall and winter, was partly evacuated, and had lost half its industrial section by April.

In Europe, many of the small countries were freed. The British landed in Greece in September, and aided in freeing it. Bulgaria, invaded by Russia, declared war on Germany in the same month—September 8. Russian troops also assisted in freeing Yugoslavia in the fall, and forced Hungary to surrender in February, 1945.

In September, the Siegfried Line was broken, and the Maginot Line was breached in November after the fall of Metz, strongest fortress in western Europe. By that time, there were seven Allied armies headed for Germany: a Canadian and a British in the Netherlands; four United States armies plunging across France and into Germany; and a French army coming up from the south. The Germans in retreat broke the dikes in the Netherlands, wrecking the work of years. The Germans, under General von Rundstedt, opened a counterattack on December 16. They drove the Americans back into the "Belgian Bulge," from which they could not emerge wholly until in January, 1945.

In late February, the Americans plunged toward the Rhine, which they crossed in early March. From March 3 to March 21, one American army alone captured 4,225 towns in the rapid advance across Germany. Soon all the Allied armies were driving forward to crush the German Army and reach Berlin.

In the meantime, the Russians had ended German resistance in the Baltic States. They took Warsaw on January 17, 1945, and continued across Poland into East Prussia. They also entered Germany through Austria. On April 22, the Russians entered Berlin and began to conquer it, street by street. Munich was taken on April 29.

Four days earlier, at Torgau on the Elbe River, American and Russian troops met, bridging the Reich. The fall of Berlin was announced on May 2. On May 7, Germany surrendered unconditionally.

On May 13, unprecedented bombing of Japan began. Okinawa Island was taken on June 22. Four days later the United Nations Charter was completed at San Francisco. President Truman, Generalissimo Stalin, and Prime Minister Churchill (succeeded by Attlee) met at Potsdam, Germany, on July 13 to plan the war against Japan and the peace. On August 6, President Truman announced the dropping of the first atomic bomb on Japan. It fell on Hiroshima, causing unbelievable destruction. Two days later, Russia declared war on Japan and invaded Manchukuo. On August 10, Japan asked for peace. Surrender terms were signed on board the *U.S.S. Missouri* on September 2.

Related Articles. The reader is referred to the topics listed below, in addition to the articles on countries involved in World War II:

Army
Atom
Chamberlain, Neville
Churchill, Winston
Conscription
George VI
Haakon VII
Hiroshima
Hitler, Adolf
Leopold III
Mussolini, Benito
Navy
Naziism
Roosevelt, Franklin D.
Stalin, Joseph
Wilhelmina

WORMS, *wur'mz*, a term loosely applied to many small, rather long, creeping animals, lacking feet entirely, or having very short ones, including such various forms as the earthworm, the grubs of certain insects and intestinal parasites. The zoologist, however, confines the term to animals belonging to the branch known as Vermes, and excludes the larvae of insects. See VERMES.

WORMS, *vormz*, GERMANY, an historic city located on the Rhine, twenty-six miles southeast of Mainz and twenty miles northwest of Heidelberg. Worms was founded in antiquity and retains parts of its original walls and towers. The fine Romanesque Cathedral of Saints Peter and Paul and the Gothic Church of our Lady are notable edifices. In this city, in 1521, Martin Luther appeared before the famous Diet convened by Charles V, and in the presence of the emperor, he refused to retract his religious beliefs (see LUTHER, MARTIN). Worms is normally a manufacturing and trading center of importance. Population, about 50,500.

WORSTED, *woos'ted*, or *wur'sted*, a tightly-twisted woolen thread made from long-fibered wool. The name comes from Worsted, the English village where it was first made. The thread is used for knitting and for weaving cloth. See WOOL AND WOOLEN MANUFACTURE.

WOUNDS, *woonds*, injuries to any of the soft parts of the body, occasioned by external violence and attended by a greater or less amount of bleeding.

Wounds are of four kinds: (1) *contusions*, or *bruises*, chiefly under the skin, caused by a fall, a blow from some blunt object, or squeezing; (2) *incised* wounds or *cuts*, where the skin or tissues are cut sharply and bleed freely; (3) *lacerated* wounds, torn irregularly by a blunt instrument, bleeding less severely but more likely to become infected; and (4) *punctured* wounds or *stabs*, made by sharp-pointed instruments such as nails or bullets, usually bleeding little, difficult to clean and often infected.

A sterile pad of gauze on the wound, and a pressure bandage or adhesive strap, will usually control bleeding. In severe cases, a tourniquet may be used. Iodine may be painted on to prevent germs from entering the wound. All wounds should be covered promptly with a sterile bandage or pad. Punctured wounds must be watched, as tetanus (lockjaw) frequently follows. Infection in such a wound should be brought to the attention of a doctor.

In World War I, French surgeons used *Dakin's solution* to irrigate wounds. The sulfa drugs were of exceptional value in World War II; powdered sulfanilamide sprinkled directly on wounds prevented infection, even though treatment was long delayed. See HEMORRHAGE; SURGERY; TOURNIQUET.

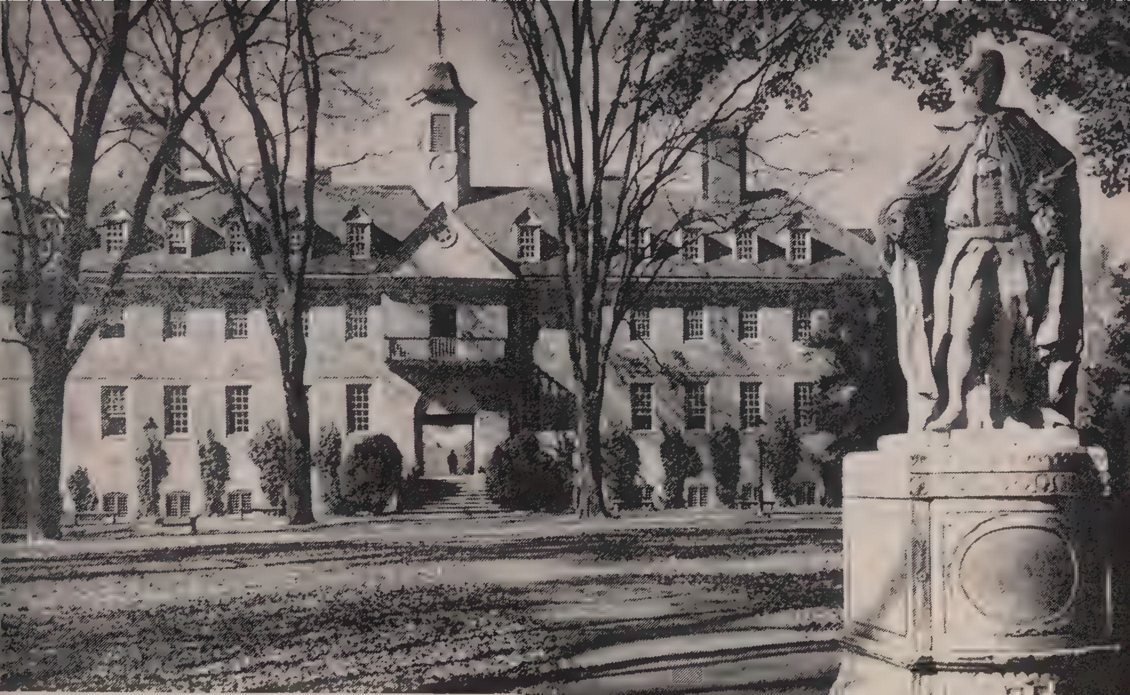
WREN, a very active little bird, common in America, Europe and Asia. The wrens are distinguished by their small size, slender beaks, short rounded wings, brown or gray mottled plumage and erect tails. The common *house wren* of the United States builds its nest in boxes or crevices, seeming to have no fear of human beings and never hesitating to attack cats, dogs, swallows and other trespassers. The eggs, three to nine in number, are white, dotted with salmon. The song of the wren is melodious and flute-like. The bird destroys large numbers of noxious insects. The largest wren in the United States is the *cactus wren* of the Southwest; the smallest is the *winter wren*, only four inches long.

WREN

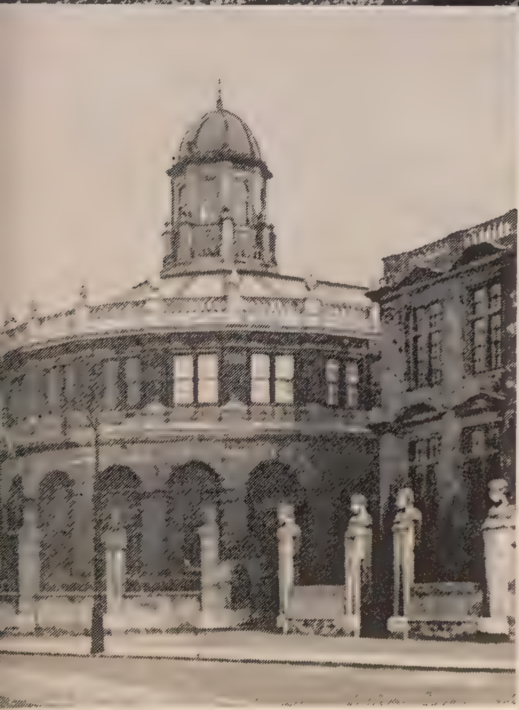
WREN, CHRISTOPHER, SIR (1632-1723), one of the greatest of English architects, born in Knowle, Wiltshire. He was educated at Waldham College, Oxford, became a fellow of All Souls in 1653, and was professor of astronomy at Gresham College and Savilian professor of astronomy at Oxford.

As a scientist, he was appointed one of the commissioners to restore Saint Paul's Cathedral. Wren was gradually drawn by consultations deeper and deeper into the problems of construction. Thus prepared, the labor of building Saint Paul's devolved largely on him, and he was occupied with the work from 1675 to 1710. At the same time he made many designs for other public buildings, and in the forty years following the great fire of 1666 there was not an important public building in London that he did not design.

Among the notable buildings he designed are the modern part of the palace at Hampton Court; the library of Trinity College, Cambridge; the Church of Saint Stephen's,

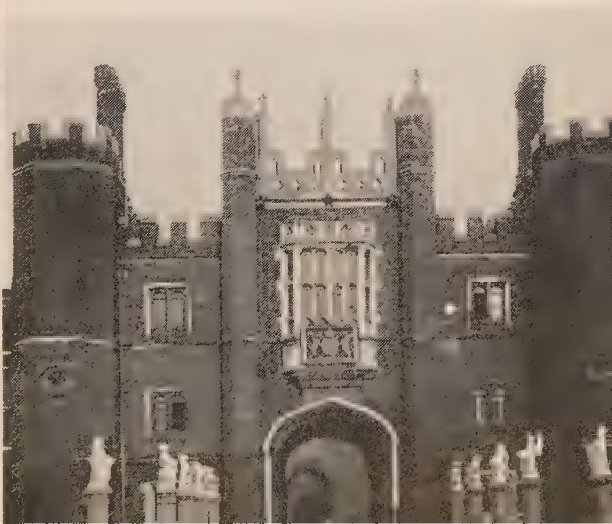


CHRISTOPHER WREN IN AMERICA is represented by the central building of the College of William and Mary, in Williamsburg, Va. It was built in 1695-98 from Wren's plans, and is the oldest college building standing in the United States. The statue is of Norborne Berkeley, Baron de Botetourt, colonial governor of Virginia (1768-70).



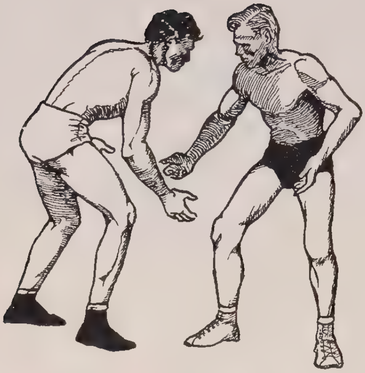
FOR OXFORD UNIVERSITY in England, Wren designed the Sheldonian Theater, where prize poems and essays are read and degrees given.

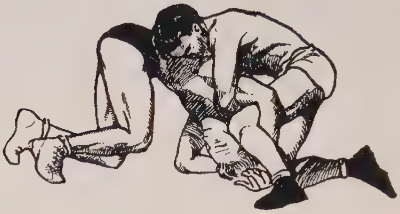
Colonial Williamsburg; Art Institute of Chicago

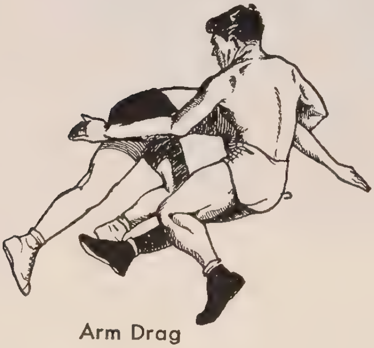


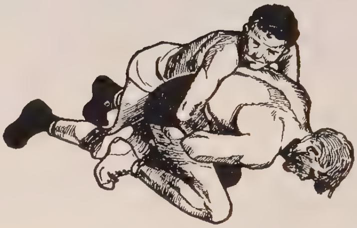
WREN DESIGNED PART OF HAMPTON COURT, a palace started in the time of Henry VIII on the Thames near London. Wren's most famous building, St. Paul's Cathedral, is pictured and described under its own title. On his tomb there, these words are carved in Latin, "If you seek a monument, look around."

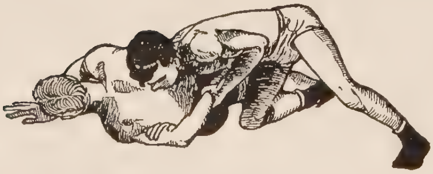
WRESTLING HOLDS

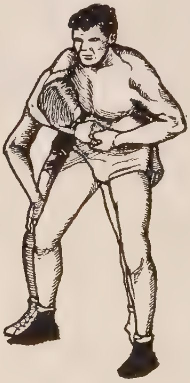

Preliminary Stance

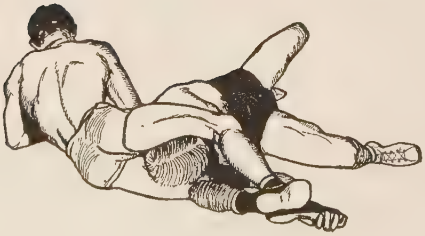

Quarter Nelson

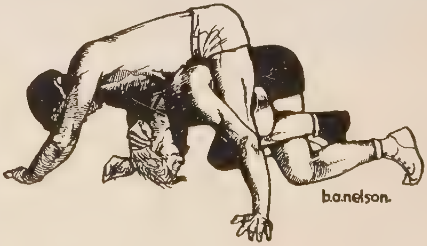

Arm Drag


Waist Lock


Twisting Hammer Lock


Head Lock, or Side Chancery


Head Scissor



Hook Scissor and Half Nelson

Walbrook; those of Saint Mary-le-Bow and Saint Michael, Cornhill; that of Saint Bride, Fleet Street, and the campanile of Christ Church, Oxford. In 1680 he was chosen president of the royal works, and from 1685 to 1700 he represented various boroughs in Parliament. Over the north doorway of Saint Paul's is a memorial tablet with the words, *Si monumentum requiris, circumspice* (If thou seekest his monument, look about thee).

WRESTLING, *res'ling,* is a competitive sport engaged in by two persons, each of whom tries to throw the other prone upon the ground. Wrestling brings into play every muscle of the body, and when under the proper restraining rules is one of the most beneficial of sports. The winner is usually the more skillful and alert.

In all Greek athletic contests, wrestling had a prominent part. The Greek wrestlers oiled their bodies. Grace was insisted upon, and the most stringent rules were enforced. Roman wrestling was of a rougher sort, in which participants were not infrequently killed. In the Graeco-Roman wrestling of modern France, the contestants are stripped to the waist. Most of the struggle takes place after both men are on the mat, and a fall is scored when one of them forces both shoulders of his opponent to the ground.

The Irish method of wrestling is known as the *collar and elbow.* The wrestlers wear short jackets with stout collars and sleeves, to afford a good grip. Each man seizes the collar of the other with his right hand and the sleeves near the elbow with his left hand. If his grip loosens, he loses. A man is thrown when two shoulders and a hip or a shoulder and two hips touch the ground.

In England a good method of wrestling is known as the *black-hold catch.* Each contestant stands with his chin on the shoulder of the other, grasping the other about the body, the right arm of each under the left arm of the other. If a contestant loses his grip or if his shoulders touch the floor, he loses.

A freer method of wrestling, common in both England and America, is the *catch-as-catch-can* method, in which holds are taken at random. Two shoulders on the floor constitute a fall. Recognized "holds," which give a wrestler great advantage, are the *grape-vine lock,* the *chancery,* the *half-Nelson* and the *hammer-lock.*

The Japanese have a system of wrestling known as *jujutsu,* a method of self-defense without weapons. A master of jujutsu can, by a slight, swift movement, benumb an opponent's brain, dislocate his hip or shoulder, or burst or twist a tendon. See JUJUTSU.

WRIGHT, FRANK LLOYD (1869–), an American architect, born at Richland Center, Wis. He studied civil engineering at the University of Wisconsin, but architecture became his life work. Wright began practice in Chicago in 1903; his designs at once attracted attention for their individuality and departure from conventional forms. His work was characterized by his use of projecting eaves and low, horizontal planes. He was the architect of the Imperial Hotel in Tokyo, Japan, and of many homes and public buildings in America, and the author of numerous books on architecture and essays on the relation of art to life. His creations aroused wide controversy.

WRIGHT, HAROLD BELL (1872–1944), a popular American novelist, born in Rome, N. Y., and educated in the preparatory department of Hiram College, Ohio. He was at various times a painter and decorator, a landscape painter, and a minister in the Disciples of Christ Church, and his first novel, *That Printer of Udell's* (1903), was written while he was preaching in Missouri. It was followed by *The Shepherd of the Hills,* a great popular success. In 1908 he retired from the ministry to devote himself entirely to writing. His later works include *The Calling of Dan Matthews, The Uncrowned King, The Winning of Barbara Worth, Their Yesterdays, The Re-Creation of Brian Kent, The Mine with the Iron Door, A Son of His Father* and *God and the Groceryman.*

WRIGHT, ORVILLE (1871–1948), and WILBUR (1867–1912), two brothers who won undying fame as inventors of a practical airplane. Orville was born in Dayton, Ohio, and Wilbur in Millville, Ind. Both were educated in the public schools. They began to study aeronautics in 1896. At this time they had a bicycle shop in Dayton.

In 1900 they began experimenting in aviation with machines of their own invention and manufacture, and three years later they had produced a machine which would remain in the air over a minute. Kitty Hawk, N. C., was the scene of early tests. In 1905 they made the first long-distance flight, near

Dayton; and in 1908 Wilbur made his first public flight in France. After the brothers had won gold medals and homage in Europe they were recognized at home, and their machine was accepted by the United States government for use in the army. The Wright machines paved the way for the improved planes of today. See AIRPLANE; FLYING, STORY OF.

WRIT, in law, a formal order issued by a court enjoining the person mentioned therein to perform some specified act. It is issued under seal, attested by the proper officer and addressed to the sheriff or some other legally authorized officer. The following are the writs in most common use:

A writ of summons commands an authorized officer to notify a person to appear in court to answer to a complaint.

A writ of replevin is an order permitting the recovery of goods illegally seized.

A writ of mandamus is a command to a person or corporation to do something pertaining to his, or its, office or duty.

A writ of quo warranto is a command to show by what right an act is performed or an office held.

A writ of error is issued to remove an action to a higher court, by reason of error in the proceedings of the inferior court.

A writ of certiorari is issued by a court of review, requiring the record of a case to be sent up from an inferior court for examination.

For writ of subpoena see Witness. See, also, Capias; Habeas Corpus; Injunction.

WRITING, signs or characters inscribed on a surface to record and communicate thought. The earliest form of writing, practiced by all primitive peoples, was picture writing, or the copying of objects direct from nature. After this came symbolical writing, developed in its highest form in the cuneiform system of Western Asia and the hieroglyphics of Egypt. The latter were abbreviated pictures used as arbitrary symbols, first of things and later of sounds and words. These systems marked the transition from ideographic to phonetic writing, in which signs represent sounds.

Of systems of writing in which signs represent syllables, the most notable is the Chinese. As the same sound may have several meanings, it is often necessary to add to a syllable some sign to indicate which meaning is intended. The Phoenicians, basing their system on the Egyptian, are said to have invented the first phonetic alphabet, which is reputed to have been introduced into Greece by Cadmus of Boeotia, about the seventeenth century, B. C. The Greek forms, modified, spread to Sicily and Italy.

Various systems of writing differ in the arrangement of their symbols. Chinese characters are read in columns from top to bottom. Mexican picture writing is read from bottom to top. Hebrew writing, a modification of one form of the ancient Egyptian, is read from right to left. Sanskrit, Greek, Latin and all modern European languages are read from left to right.

Whole medieval manuscripts were written in large or small capitals. Uncial letters, which prevailed from the seventh to the tenth century, were rounded capitals, with few hair strokes. Gothic characters, fanciful deviations from the Roman types, became common from the thirteenth to the fifteenth century. In England, in the early Middle Ages a variety of styles called Saxon prevailed. A mixed style was formed of a combination of Roman, Lombardic and Saxon characters; the Norman style came in with William the Conqueror; and the English court hand, an adaptation of Saxon, prevailed from the sixteenth century to the reign of George II.

There have been various unsuccessful attempts to introduce phonetic writing. Systems of shorthand are generally phonetic. Thus, shorthand users write *enough* as if it were spelled *enuf*, and *tough* as *tuf*.

See ALPHABET; HANDWRITING; HIEROGLYPHICS; SHORTHAND.

WRITS OF ASSISTANCE. In American colonial days the British customs officials were provided with general search warrants to aid them in collecting import duties. These warrants were called *writs of assistance*. These writs differed from ordinary search warrants in that they did not limit the officer's search to a specified time or place, or to specified goods, but authorized him to seize any suspected goods.

The first writ of this kind was issued in 1761 and aroused much opposition. James Otis, advocate-general of the colony of Massachusetts, resigned his office and became leading attorney in a case in opposition to the issuance of the writs. The writ was declared legal, but it was rarely, if ever, used.

WROCLAW, formerly BRESLAU (which see)

WRY'NECK, a European bird related to the woodpeckers, but, unlike the latter, unable to climb. It makes its nest in the natural cavities of trees, and lays from seven to

SKF Industries, Inc.

The First Flight of the Wright Brothers' Flying Machine at Kitty Hawk, N. C.

[See Wright, Orville and Wilbur]

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BEFORE MAN FLEW, HE DREAMED OF FLYING. Even the ancient Greeks envied the birds. They told the legend of Icarus, whose father made him wings so he could fly out of prison. Icarus flew too near the sun, and the heat melted the wax that held the feathers on. He fell and was drowned.

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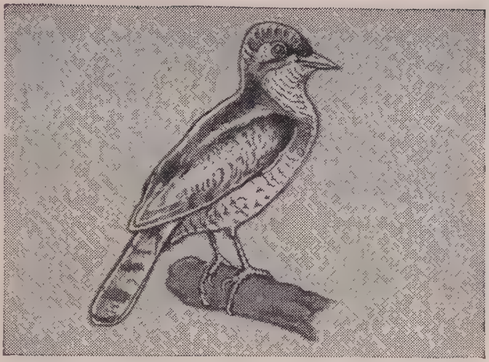


WRYNECK

twelve shiny, white eggs. It eats ants and other ground insects, which it captures with its bill or with its wormlike tongue. When disturbed, the bird thrusts its head out over its nest with an undulating movement, which has given it its name. Its habit of hissing has earned for it the sobriquet *snake bird.*

WUPPERTAL, GERMANY. See ELBERFELD.

WURTTEMBERG, *vürt'em berK,* GERMANY, formerly a kingdom and one of the divisions of the German Empire prior to 1918, became a division of the Third German Reich in 1934. It joins Bavaria and Baden. It has an area of 7,528 square miles, and a population of nearly 3,000,000. In the Middle Ages, Württemberg was a county. In 1495 it was erected into a duchy and in 1806 became a kingdom.

WYANDOTTE, *wi' an dot.* See HURON.

WYANDOTTE CAVE, remarkable natural cavern in Crawford County, Ind., five miles northwest of Leavenworth. It is next to Mammoth Cave in size and has been explored for about twenty-three miles. It is noted for its large chambers, some of which are 200 feet high and 300 feet broad. The stalactite formations in this cave are of unusual magnitude and beauty. Those in the room called Pillared Palace are of especial interest. Monument Mountain is a group of stalagmite columns 175 feet high.

WYCLIFFE, or **WICLIF**, *wik'lif,* JOHN (about 1320–1384), an English reformer, born at Hipswell, in Yorkshire, England. At sixteen he entered Oxford, became a fellow of Merton College, and later master of Balliol College.

In disputes between Edward III and the Papal court, concerning tribute, the English Parliament had resolved to support the sovereign. Because Wycliffe took a prominent part in this affair, Pope Gregory XI wrote letters to the king, the Archbishop of Canterbury and the University of Oxford, to have him tried for heresy. In subsequent sermons, Wycliffe attacked the higher clergy, accusing them of having assumed undue power and unbecoming arrogance.

In 1380 he opposed the doctrine of transubstantiation at Oxford, and two years later he was summoned to appear before a commission of bishops and doctors at London. He refused to attend the trial. Ten out of twenty-four articles culled from his writings were condemned as heretical, and fourteen were declared erroneous. He was deprived of his professorship and expelled from the university. Wycliffe returned to Lutterworth, in Leicestershire, where Edward had given him a rectory. Part of his time was spent in translating the Bible from the Vulgate. This first systematic attempt to translate the whole Bible into English was an important contribution to English prose. Wycliffe continued to uphold the Scripture itself as the highest explanation of the divine law. Young men sent out by him to preach the plain, straightforward word of God were known as *poor priests.* Wycliffe's followers were active in spreading his teachings, which for about a generation after his death were a powerful religious and political factor. See LOLLARDS; BIBLE; LITERATURE; REFORMATION, THE.

WYOMING, a Rocky Mountain state in Northwestern United States, located on the Rocky Mountain Plateau. It is rectangular in form, its boundaries being formed by meridians of longitude and parallels of latitude. It lies between Montana on the north and Colorado on the south, with South Dakota and Nebraska on the east and Idaho and Utah on the west. The name, meaning *large plains,* was taken from that of the Wyoming Valley in Pennsylvania. The word

Wyoming is from the Delaware Indian name *Maughwauwama.* Yellowstone National Park, which with its adjoining forest reserve has an area of 5,000 square miles, occupies the northwestern corner, extending over the boundary into Idaho and Montana. Grand Teton National Park, of 150 square miles, was established in 1929. (See illustration in the article PARKS, NATIONAL.) Wyoming from east to west extends 355 miles; the width is 276 miles. The area is 97,914 square miles, of which 408 square miles are water. Wyoming is eighth in size among the states.

The People. In 1950 the population was 290,529, with a density of 3.0 persons per square mile. Nevada is the only state having a smaller and a more sparsely settled population. Less than 10 per cent of the inhabitants are foreign-born; of these the English, Swedes, Germans, Italians, Scotch, Russians, Yugoslavs and Canadians are the most numerous. The Shoshone and Arapaho Indian reservations—west of the central section and near the Continental Divide—cover an area of about 3,000 square miles; the Indian population is about 2,500. In 1950 the population was 49.8 per cent urban.

Surface and Drainage. The surface of the state, for the most part, is composed of mountains and plateaus. The great plains of the Mississippi valley slope away from the foothills in the east. The elevation varies from 3,500 to 13,785 feet, the highest point being Mt. Gannet. The main axis of the Rocky Mountains, which forms the Continental Divide, extends from north to south. The northern group of these mountains finds here its greatest development and is noted for its wild character and its picturesque scenery. Yellowstone National Park, 3,348 square miles in area, occupies the northwestern corner of the state. In the west central part are the Wind River Mountains; in the north central part, the Big Horn Mountains, and in the extreme northeast, the Black Hills, extending into South Dakota; in the southeast is the Laramie range; in the south, the Medicine Bow Mountains, and in the west the Teton, Gros Ventre and Shoshone ranges. The southwestern portion of the state slopes towards the Pacific Ocean and forms a part of the Grand River Valley. From the eastern and western slopes of the Rocky Mountains, several rivers take their rise, among them the North Platte, the Green, the Snake, the Laramie and the Shoshone.

Climate. Wyoming has the typical climate of the mountainous region of the northwest. The air is pure and dry, clear weather prevails and the high altitude is for many healthful. The average annual temperature is 45.5°; the mean annual rainfall, 12.98 inches.

Mineral Resources. In every mountain range of Wyoming, gold, silver, lead and copper ores are to be found, but as yet these resources have not been largely developed. Gold, silver and copper, however, are mined in paying quantities. Coal mining is usually most important, the annual output being about 8,000,000 tons, and there are over 20,000 square miles of coal lands, from which a steadily-increasing tonnage is being mined. Valuable iron deposits are found in various localities in the state. Petroleum occurs in Fremont and Natrona counties, and its production rivals that of coal in importance; natural gas and natural gasoline rank next in importance. Extensive phosphate beds are found in Uinta County. The state also possesses extensive deposits of soda and an abundance of valuable building stone.

Agriculture. Below the timber line, the mountains are covered with forests of coniferous trees. Between the mountain ranges are broad plateaus, with arable soils, which by means of proper irrigation yield prolific crops. On account of the slight rainfall it has been supposed that only a small part of the state was capable of cultivation. However, modern methods of moisture conservation have brought vast areas under cultivation. Irrigation ditches also have been carried long distances from the source of water supply. The result has been an immense increase in the tillable area. The raising of livestock is the most important agricultural industry. The nutritive grasses which so abundantly cover the great ranges of the pasturage support many thousands of cattle and sheep. Oats, potatoes, wheat and hay are the principal crops.

Irrigation is being largely extended. The Shoshone project, the greatest in the state, includes a remarkable dam, 328 feet high, across a narrow canyon. The dam is only 85 feet long at the bottom and 200 feet at the top. A smaller dam diverts the waters of the Shoshone River, through a tunnel 3¼ miles long, into a canal which for 40 miles passes only the upper edge of a broad and fertile valley containing 150,000 acres. Near

WYOMING

THE EQUALITY STATE

1

2

3

4

5

Chicago, Burlington & Quincy R. R.

(1) Grand Canyon and Great Falls of the Yellowstone, in Yellowstone National Park. (2) Roundup of beef cattle, important in Wyoming's livestock industry. (3) Devils Tower National Monument, consisting of five-sided columns of volcanic rock; the oldest national monument in the United States. (4) Old Faithful, in Yellowstone National Park. (5) Sugar beets.

Douglas, in Converse County, and in Natrona, Johnson and Sheridan counties there are large irrigated areas.

Manufactures. As Wyoming is an agricultural and mineral state and still in the first steps of material development, it has no distinctive manufacturing interests. The most important manufacturing industry is car construction and railway repair, and next in importance is the manufacture of lumber and timber products.

Transportation. The principal railroads are the Union Pacific, the Chicago, Burlington & Quincy and the Chicago & North Western. The total operative mileage is over 2,000.

Government. The legislature has a senate of 27 members, elected for four years, and a lower house of 62 members, elected for two years. The sessions are biennial, and are limited to forty days. The executive department consists of a governor, a secretary of state, an auditor, a treasurer and a superintendent of public instruction, each elected for four years. The courts consist of a supreme court, consisting of a chief justice and two associates, and such inferior courts as the legislature may establish.

Educuation. The University of Wyoming, chartered in 1886, is situated at Laramie and is the leading educational institution. The expenses of the public school system are provided for in part by the rental of government lands which are set aside for school purposes. The total extent of lands which may be so used is 3,600,000 acres.

The state school system is in charge of a State Board of Education, with a commissioner, elected by the board, as the executive officer. There is a state superintendent of public instruction, who is a member of this board, but his relation is chiefly advisory.

Institutions. There is a soldiers' home at Buffalo, a hospital for the insane at Evanston, a school for defectives at Lander, an industrial institute at Worland and a state hospital at Rock Springs. The penitentiary is at Rawlins. At Thermopolis there is the Big Horn Hot Springs Reserve.

Cities. The chief cities are Cheyenne, the capital, Casper, Laramie, Sheridan and Rock Springs.

History. Wyoming was a part of the territory included in the Louisiana Purchase of 1803, with the exception of the southwest corner, which was a part of the territory acquired from Mexico in 1848. The first white man supposed to have visited the region was Sieur de la Verendrye, in 1734. He was seeking sites for fur-trading posts. White hunters visited the Yellowstone region in 1807, and from that time hunters began to traverse the territory.

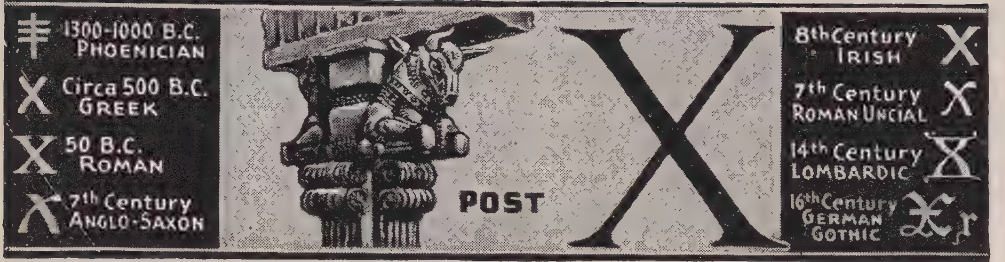
The first permanent settlement was made at Fort Laramie in 1834. Most of the immigration to California and Oregon passed through the territory, but not until the completion of the Union Pacific Railroad in 1869 were settlers attracted to the country. The Indians were hostile, and long before the construction of the railroad the government had built a chain of forts for the protection of immigrants. The discovery of gold in 1867 increased the number of settlers, and in 1869 Wyoming became an organized territory. Yellowstone National Park (which see) was created in 1872. Wyoming was admitted into the Union as the forty-fourth state on July 10, 1890. From the organization of its first government the state has given women equal suffrage with men. From this practice it received its popular name, THE EQUALITY STATE.

Related Articles. Consult the following titles for additional information:

Bighorn River
Black Hills
Cheyenne
Laramie
Rocky Mountains
Shoshonean Indians
Snake River
Yellowstone National Park
Yellowstone River

WYOMING, UNIVERSITY OF, a coeducational state institution, founded at Laramie in 1886. It comprises colleges of liberal arts, agriculture, engineering, education and law; divisions of music, home economics, commerce and university extension; and a summer school. The agricultural experiment station and the co-operative agricultural extension service are operated in connection with the agricultural departments. There is a staff, including instructors, administrators and others, of over 200 and a student enrollment of more than 3,500. The library contains 97,000 volumes.

WYOMING VALLEY MAS'SACRE, a fearful massacre in Wyoming Valley, Pa., on July 3 and 4, 1778, perpetrated by an English and Indian force against the American settlers of the valley. A vast majority of the inhabitants, including women and children, were slain in the course of two days' slaughter, and the rest fled eastward to the nearest settlements. The valley was not settled again for several years.



X, the twenty-fourth letter of the alphabet and the representative of what might as well be denoted by *ks* or *gs*. The letter *x* was originally Phoenician, and until a late date the last in the Roman alphabet, but *y* and *z* were finally added from the Greek. As an initial letter, it is pronounced like *z*.

In algebra, *x* is the usual symbol for the unknown quantity. In Roman numerals X signifies ten, perhaps from the fact that it represents a V standing upon a second V inverted.

XANTHIPPE, *zan thip'pe,* the scolding wife of the philosopher Socrates, whose forbearance with her quarrelsome temper was a salient trait in his character. The name has become proverbial as that of a scolding shrew.

XAVIER, *zav'e er,* Francisco de (1506–1552), better known as Saint Francis Xavier, was a Jesuit missionary in Asiatic countries, earning the title "Apostle of the Indies." He was a native of Northern Spain, the son of a nobleman whose family seat was Xavier. He was sent to Paris to be educated, and with Loyola he founded the Society of Jesus. In the early part of 1540, he was chosen for the mission to India. From Goa, where he arrived in May, 1542, he extended his labors southward to Ceylon, Malacca and Celebes. He spent two years in Japan and returned to Goa to organize a mission to China, but before he could overcome the difficulties in his way, he died. Xavier was canonized in 1622.

XENIA, *ze'ne ah,* Ohio, the county seat of Greene County, fifty-five miles southwest of Columbus, on the Little Miami River and on the Baltimore & Ohio and the Pennsylvania railroads. The city is in a productive farming region. There are extensive cordage works, shoe factories, machine shops and rubber and candy factories. The Xenia Theological Seminary and the Ohio soldiers' and sailors' orphans' home are located here. A courthouse, a Carnegie Library and a Federal building are prominent features of the city. Wilberforce University for colored students is located three miles north. There are interesting Indian mounds and relics in the vicinity, as well as in other near-by sections of the state. Xenia was settled in 1803, and was incorporated five years later. It received a city charter in 1870. The population is about 13,000.

XENOPHON, *zen'o fon* (about 434–about 355 B. C.), an Athenian historian and general, a pupil of Socrates. When about forty years of age, he joined the expedition of Cyrus against Artaxerxes. Cyrus was killed in the Battle of Cunaxa, and the Greek generals were put to death. The ten thousand mercenaries then chose Xenophon as their leader, and he brought them out of the strange country to the Black Sea. On his return to Greece he fought with Sparta against Athens.

Xenophon wrote numerous works, and all of these, it would seem, have come down to us. His leading works include the famous *Anabasis,* which describes the expedition of Cyrus already referred to, especially the retreat of the Ten Thousand; the *Memorabilia,* a record of the life and teachings of Socrates; the *Hellenica,* which gives a somewhat dull account of forty-eight years of Greek history and is a continuation of the history of Thucydides, and several minor works. Xenophon's writings are clear and accurate, and are among the best sources of information regarding some of the most important events of past history; but his style is often commonplace and monotonous.

XERXES, *zurk'zeez,* the name borne by three kings of Persia, the most celebrated of whom was Xerxes I (see next page).

Xerxes I, the son of Darius I, succeeded to the throne of Persia on his father's death, in 485 B. C. After suppressing a revolt in Egypt, he began to make plans for the invasion of Greece, the preparations for which had been begun by his father. These preparations were on the most enormous scale. Provisions were stored up on the intended route for three years, a transport fleet was collected, the engineering skill of the day was exerted to remove land obstacles and the resources of the vast Persian Empire were taxed to the utmost to produce an armament sufficient to crush Greece. According to ancient computation, the invading army numbered over two million, although this is possibly an exaggeration.

At the head of his enormous host, Xerxes advanced unopposed until he came to Thermopylae; but here his fleet was seriously damaged by a storm, while the narrow pass was effectually held by Leonidas, at the head of a determined, though small, band of Spartans. At last the passage was effected through treachery, and Xerxes marched on through Phocis and Boeotia to Athens, which he entered without opposition. In the meantime the Persian fleet had met with several mishaps. In two engagements with the Greek ships at Artemisium, it had suffered considerable damage, and a storm which occurred between the two conflicts was the cause of still greater loss. Finally, at Salamis (480 B. C.) a naval battle was fought, one of the most decisive in the history of the world, in which the Persians were defeated with terrible loss. Xerxes, who from a lofty eminence had watched the destruction of his fleet, fled panic-stricken to Sardis, leaving in command of his army Mardonius, who was defeated the following year at Plataea. Xerxes spent the rest of his life in obscurity and was murdered by Artabanus, the commander of his bodyguard, who was plotting to make himself king of Persia. He was succeeded by his son Artaxerxes I.

Xerxes II was the son of Artaxerxes I. He was born about 450 B. C. and lived twenty-five years. On the assassination of his parents he ascended the throne but was murdered about a month later.

The third Persian ruler of this name, who was also called OARSES, ruled about 337 B. C.

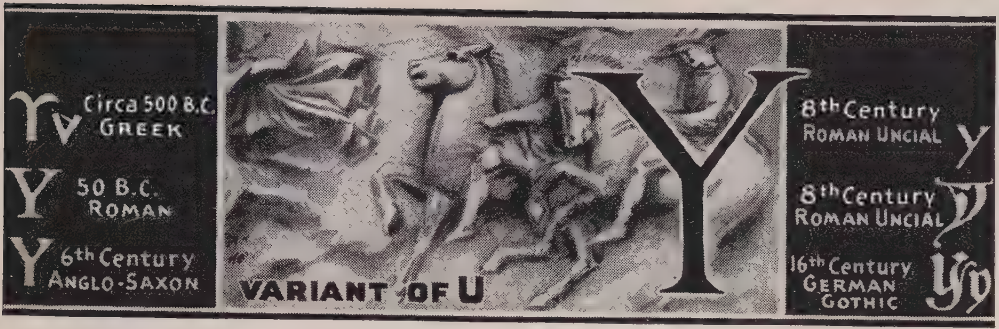
X-RAY. See ROENTGEN RAYS.

XYLOPHONE, *zi'lo fone,* a musical instrument. Small bars of wood, selected for their sounding quality, or pieces of metal of graduated length are fastened upon a horizontal frame in such a manner as to form the chromatic scale. The player uses two small mallets, one in each hand.

J. C. Deagan, Inc.

THE MARIMBA
A development of the xylophone.

X Y Z CORRESPON'DENCE, the name given to the dispatches sent in 1797–1798 to the United States government by its commissioners, Charles Pinckney, John Marshall and Elbridge Gerry, in Paris. These men were sent to France to settle certain difficulties with that government. On their arrival they were not received officially, but were compelled to communicate with the government through three agents, who informed them that the first step toward negotiation would be the payment of a large sum of money to the Directory, which was then in control of French affairs. The American commissioners, with the exception of Gerry, promptly withdrew and transmitted the correspondence to President Adams, who, in turn, laid it before Congress, substituting for the names of the French commissioners the letters X Y Z. The correspondence aroused the bitterest feeling in the United States, and a naval war with France was actually begun, but the French government receded from its position and thus averted a struggle. See ADAMS, JOHN.



Y, the twenty-fifth letter of the English alphabet, was derived from the Greek *upsilon,* by way of Latin. The Greek letter came from the Phoenicians, and the Romans borrowed it from the Greeks. In English the letter *y* represents some sounds that are like the vowel *i* and some that are between a vowel and a consonant. In words like *by, pony, hymn, dye, y* is a vowel; in combinations with other vowels, as in *boy, pray,* it is a semivowel; and in forms like *yes, your,* it is more like a consonant. In Old English before 1400, *th* was often written as *y. Ye* was merely an abbreviation for *the,* and *yt* an abbreviation for *that.* See also ALPHABET.

YACHT, *yot,* **AND YACHTING.** In a broad sense, any sail or power-driven boat used only for pleasure or sport may be called a yacht. The name comes from the Dutch *jacht,* meaning *pursuit ship,* or, originally, a ship used against pirates. The ancient Egyptians as well as the Greeks and Romans used vessels of various kinds for pastime sailing, but the Dutch were probably the first people to build boats for pleasure rather than for commerce. Today such boats are found on rivers, lakes, and oceans in almost every part of the world.

Most sailing or power yachts are used for day sailing or long-distance cruising; only a few are ever raced. Much of the pleasure of owning a yacht is in the work of upkeep and management, including navigating and cooking — all done usually by the owner himself. Seamanship is an art at which each owner strives to improve. Old or young, men or women, can enjoy this sport. Although the finest, largest boats may require substantial sums to purchase and operate, a small used boat can be purchased and maintained at not more than the cost of a used automobile. Too, most yacht clubs are inexpensive to join, and most of them welcome new boatowners to membership. In the United States and Canada, several clubs with widespread membership offer courses in seamanship and navigation to members. There also are various special magazines dealing with yachting and many books on the sport.

Yacht races or cruises may be short- or long-distance. A long-distance sailing race is usually called a cruising race. In the United States the Bermuda, the Mackinac, and the Honolulu races are famous cruising races requiring several days to complete. There have been various transatlantic races.

Sailboats used for racing are usually developed in classes where all boats in a class are very much alike, and they race without handicap, or time allowance, or they are measured to a formula to arrive at handicaps. The principal factors in the various formulas are sail area, waterline length, and ballast ratio with displacement. Powerboats used for racing are classified on the basis of cubic volume of the engine cylinder or by size of the hull.

History of Yachting. The early history of yachting centers largely in the British Isles, where, during the reign of Elizabeth I, a yacht to be used for racing was built at Cowes, England. In 1662 a yacht designed by

RUNNING BEFORE THE WIND, a cruising-class yawl presents a perfect picture of speed, grace, and beauty.

Morris Rosenfeld

Ewing Galloway

NO THING OF BEAUTY, the yak, as a beast of burden, plays an important role in trade and transportation in mountainous Tibet.

Charles II outstripped a Dutch yacht in what was probably the first yacht race. The first yacht club was founded in Cork, Ireland, in 1720, and in 1812 the club that later became known as the Royal Yacht Squadron was organized at Cowes. Toward the middle of the nineteenth century, yachting and yacht racing began to win popularity in the United States, and in 1844 the famous New York Yacht Club, the first of more than eight hundred American yacht clubs now in existence, was founded.

The first international yacht race was sponsored by the Royal Yacht Squadron and took place in English waters in 1851. It was won by the American yacht "America," and the trophy was the America's Cup, from then on the most coveted of the international yachting trophies. Since 1870 a number of races have been sailed for this Cup, but it has always remained America's trophy. The best-known contender for the Cup was the British yachtsman Sir Thomas Lipton, with his five yachts, each called "Shamrock."

For many years yachting was a rich man's sport, carried on with large yachts staffed by professional crews. More recently small boats have become increasingly popular, and owners and amateurs racing their own yachts have largely replaced professional yachtsmen. See also LIPTON, SIR THOMAS; MOTORBOAT; SAILBOATS AND SAILING.

YAH'WEH, or **JAHVEH**, *yah' veh.* See JEHOVAH.

YAK, a type of cattle native to central Asia. The wild yak, which lives in the mountains of Tibet at altitudes of 13,000 to 20,000 feet, is a short-legged but powerful beast, standing over five feet high at the shoulders. Its muscular body is clothed in blackish-brown fur, with fringes of long, soft hair hanging from the chest, legs, flanks, and tail. Its smooth, round horns curve out from the sides of the head and upward. Domesticated, or tame, yaks are somewhat smaller and may be black, brown, red, gray, piebald, or albino (white) in color. Sometimes they are hornless. Despite their bulk, yaks are extremely sure-footed and for hundreds of years have made excellent pack and saddle animals for crossing the rugged Tibetan mountains. In addition, they furnish the natives with good-tasting meat and rich milk, butter, and cheese. Yak hair is woven into cloth and rope, the hides are made into leather, and the bladders are used for water bags. The horselike tail of the yak is sometimes used as an ornament and in the tropics as a brush.

Scientific Name. *Bos grunniens.*

YAKIMA, *yak'ih muh,* an Indian tribe living in western Washington. In early days these Indians hunted deer and elk and fished in the rivers. Their dwelling was the gabled mat-covered lodge of the Plateau peoples. In the eighteenth century they acquired horses and adopted the tepee and the beaded buckskin clothing of the Plains Indians. Their women have always been famous for a soft basket bag, made at one time of twined Indian hemp and later of cornhusk. In 1855, when the Yakima ceded their lands to the government, a rebellion broke out that lasted until 1858. There are now about three thousand Yakima and related tribes on the Yakima Reservation in Washington. The seasonal work in the hop fields and fruit orchards, one of their chief occupations, resembles their old food-gathering way of life. Once a year, at the Pendleton, Ore., roundup, they present a magnificent display of buckskin-clad figures on horseback. See also INDIANS, AMERICAN.

YALE, ELIHU (1649-1721), an English merchant for whom Yale College was named, was born in Boston. His grandmother, who had come from Wales with her family, lived in New Haven, Conn. Elihu's father returned to England in 1652, and the boy was educated in London. He went to Madras (India) in 1671 as an official of the East India Company and made a fortune there before coming back to settle in London and on the family property in Wales. He gave some books to the Collegiate School at Saybrook, Conn., and in 1718, Cotton Mather asked him to contribute to the new building the college was to occupy in New Haven. Yale sent the trustees more books, a painting, and some goods to be sold. The gift came to several thousand dollars, and in recognition the trustees named the college after its benefactor. It is now Yale University.

YALTA, *yawl'tuh,* **CONFERENCE**, or **CRIMEA CONFERENCE**, a meeting of Allied leaders held February 4-11, 1945, during World War II, on the shore of the Crimean peninsula. It was attended by President Franklin D. Roosevelt of the United States, Prime Minister Winston Churchill of Great Britain, and Marshal Joseph Stalin of Russia. The purposes of the conference were to plan for Germany's surrender, which was already in sight, to begin long-range planning for world peace through the United Nations, to work out the best method of winning the war in the Pacific, and to discuss postwar problems in the Far East.

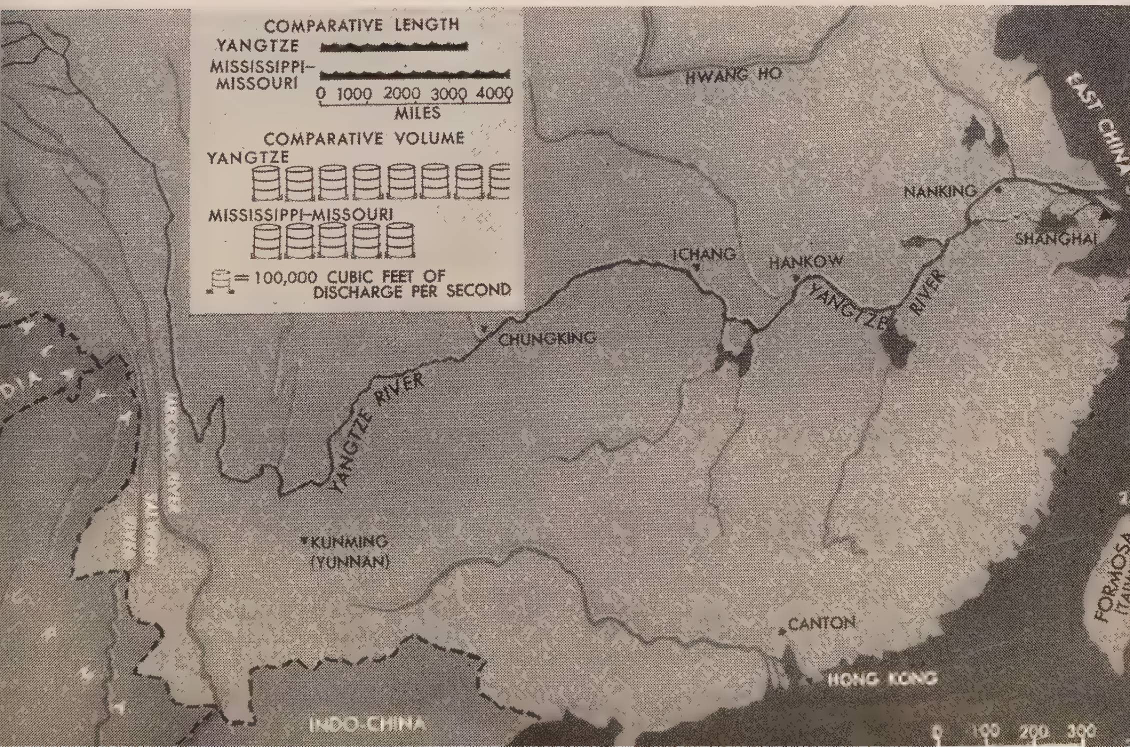
The three nations decided that Germany should be divided into four zones of occupation, under an Allied control commission with headquarters in Berlin. War criminals were to be prosecuted, and Germany was to pay reparations. The Germans were to be stripped of all military power and much of their industrial strength. The United States, Great Britain, and Russia agreed to invite France and China to be sponsors of the United Nations when the permanent organization was set up. The Council of Foreign Ministers was established, so that preliminary work could be started at once.

The combined chiefs of staff of the United States and Great Britain thought that Russia's help in the proposed invasion of Japan was essential. Stalin agreed to enter the war against Japan within three months of the German surrender. He promised to support the Nationalist Government of China. In return for these concessions Russia wanted to get back the southern part of Sakhalin Island and the Kuril Islands, which had been lost to Japan in the Russo-Japanese War. The Russians wanted to have Outer Mongolia remain independent, and they asked to have Dairen made a free port. Port Arthur was to be a Russian naval base, and Russia was to have a half interest in the Japanese-controlled Chinese-Manchurian railroads.

Although China was not represented at the conference, these concessions were accepted as part of the agreement. The Soviet Union entered the war as Stalin had promised, but the pledge to support the Chinese Nationalists was not kept. The concessions to Russia were later condemned by critics of American foreign policy under Roosevelt and Truman.

YALU, *yah' loo'*, **RIVER**, a river of eastern Asia rising in the mountain range known as Chang Pai Shan and forming a part of the boundary between Manchuria and Korea throughout its course. It flows southwestward five hundred miles to the Yellow Sea. Antung, in Manchuria, near the mouth of the river, is the chief city on the Yalu. The river is icebound for part of each year, but during the warmer months logs are floated downstream, and there is some shipping on the lower river. The Yalu has great importance both as an international boundary and as the site of large hydroelectric plants. It took on special significance during the Korean War, when planes, troops, and equipment crossed the Yalu from Communist China to join forces with the North

THE LIVELIHOOD OF MILLIONS OF CHINESE — farmers, city dwellers, and boatmen — depends upon the mighty Yangtze River, which is both a great commercial waterway and a source of irrigation for a vast area.



Princeton Municipal Improvement, Inc.

YANKEE DOODLE DANDY bounces along on his pony in this detail from a colorful mural by the famous American artist, Norman Rockwell.

Koreans against South Korean and United Nations forces. See also KOREA.

YAM, a genus of tropical twining vines bearing large, starchy, tuberous roots. The tubers of some yams are an important food in various tropical regions, where they are cooked in much the same way as potatoes. In the United States, especially in the Southern states, large varieties of sweet potatoes are called yams, but the two plants belong to different families. Yams are related to the lilies; the sweet potato belongs to the morning-glory family. Edible yams are grown very little in America, but the *cinnamon vine,* a species of yam native to China, is cultivated in the northern United States. Its glossy leaves and cinnamon-scented white flowers make it an attractive vine for porches. The root of a wild Mexican yam is the starting point of a process that has yielded several synthesized drugs, including cortisone, used in treating arthritis.

YANGTZE, *yang'tsee,* or **YANGTZE KIANG**, *kih ang',* the greatest river of China, rises high in the mountains of eastern Tibet and winds through mountain gorges and canyons down to the thickly settled Yangtze plain. It empties into the East China Sea by way of a large delta that begins near Nanking, more than 200 miles upstream. Near the mouth of the Yangtze, which is an estuary fifty miles wide, is Shanghai, the largest city in China. The total length of the river is about 3,400 miles; for half of this distance it is the chief highway of a very fertile and densely populated region.

Ocean-going ships reach Hankow, an inland port 630 miles from the sea, and the Yangtze is navigable for river vessels for another thousand miles, well beyond the one-time capital, Chungking. Where the river grows too shallow for junks or river steamers, bamboo rafts and skin canoes are used. West of Ichang, about 1,000 miles upstream, the Yangtze rushes through a series of spectacular rocky gorges, dangerous and difficult to navigate. The water is probably more than 400 feet deep in some of these canyons. Rainfall is heavy in many parts of the country drained by the Yangtze, and the river has tremendous volume. In the rainy season the river level may rise more than 50 feet in the gorges, but the many lakes and canals that form part of the river system take care of the flood waters, and the Yangtze seldom overflows in floods as the Hwang Ho, or Yellow River, does. It carries about 600,000,000 tons of sediment to the sea each year, pushing the delta out at the rate of a mile every sixty or seventy years. The Yangtze drains an area of about 690,000 square miles. See map on preceding page; also ASIA; CHINA.

YANKEE, in the United States, a popular nickname for the people of New England or, as used in the South, for any Northerner. In other countries, all Americans are sometimes referred to as Yankees. The word came into use in colonial times, but scholars do not agree on its origin. Some see its beginning in the name *Janke,* or *Jan,* which Dutch New Yorkers used as a general name for their English neighbors. Others believe that *Yankee* comes from Indian attempts to pronounce the word English. And there are still other explanations. The British scornfully referred to the colonists as Yankees during the Revolutionary period, and during the War between the States the people of the Confederacy called their Northern opponents Yankees. In Europe, during both World Wars, Americans were called Yankees or Yanks, though during and after World War II the term "Ami" — short for American — came into wide use.

YANKEE DOODLE, a patriotic song of the United States which became popular during the Revolutionary War. Its origin is obscure, but many authorities assert that the tune is derived from an ancient harvest song popular as far back as the tenth century. The doggerel words are believed to be the work of Richard Schuckburgh, an English army surgeon, who ridiculed the awkward American volunteers participating in the French and Indian War. Variations of the theme have been used by many composers, notably Dvořák in the last movement of his symphony *From the New World.*

YAP, a group of four small volcanic islands enclosed by a barrier reef, forms part of the Caroline Islands in the western Pacific. Yap lies south of Japan, at about 10° north latitude. The islands, which have an area of about eighty square miles, are the tops of mountains rising from the floor of the Pacific. They are inhabited by several thousand brown-skinned, dark-haired natives, who speak a language that is related to Polynesian.

The men of Yap, who are very good swimmers, spear fish in the deep waters along the reef. The women, in grass skirts made of coconut palm leaves, work in the fields, where rice, yams, and other vegetables are grown. Bananas, oranges, and papayas are abundant. The coconut palm furnishes logs and matting for the houses, twine to hold the structure together, and copra, or dried coconut, the main cash crop (see COPRA). The natives use strings of shell as money, if they cannot deal by barter, but they also have a kind of stone money — huge, circular, flat stones with a hole in the center. These come from the Palau Islands, more than 250 miles to the southwest. Set up in front of a house, they show that the owner is wealthy. (See illustration in the article PACIFIC ISLANDS.)

Yap is one of the stations on the transpacific cable, and during World War II it was a Japanese naval base. Although it was bombed by American fliers, American forces by-passed the island without attacking, and the Japanese garrison surrendered at the end of the war. With the other islands of the Caroline group, Yap was placed under mandate to the United States by the United Nations after the war. The United States Navy administered the trust areas until 1951, when the Department of the Interior took over the responsibility. See also CAROLINE ISLANDS; PACIFIC ISLANDS.

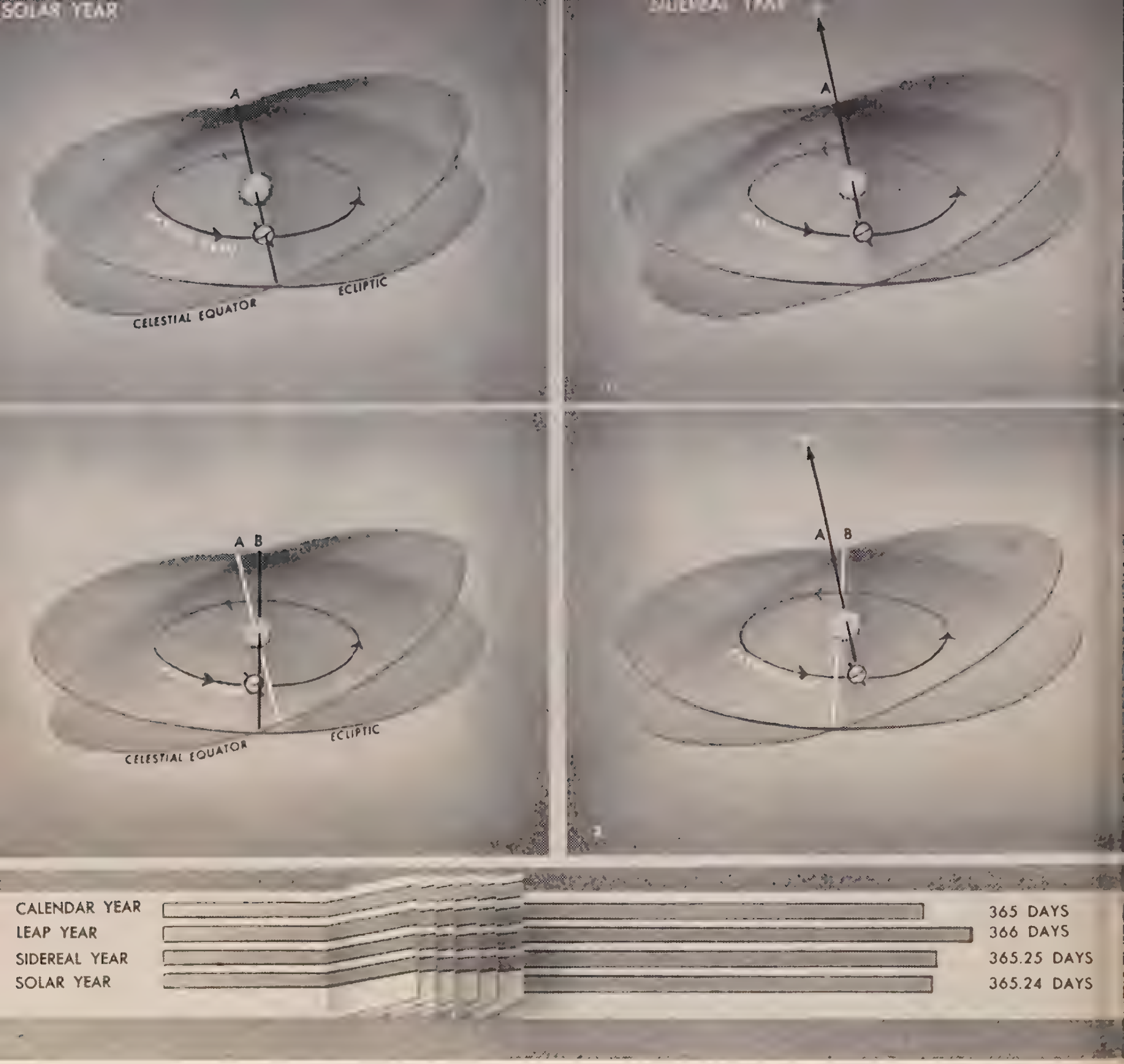
YAQUI, *yah'kee*, a warlike Indian tribe of northern Mexico. Originally the Yaqui were farming people, cultivating corn, beans, squash, and cotton. They lived in square houses made of poles covered with clay, wove mantles of cotton and wool, and made reed baskets. Although they adopted the Catholic religion and the Spanish language, they came into conflict with both the Spaniards and the Mexicans. Many became day laborers in the mines and fields, but the Indians remained troublemakers, and in 1906 the Mexican Government attempted to deport them to Yucatán. The Yaqui resisted and are now scattered over northern Mexico, though there is a large colony at Tucson, Ariz. Here they continue their native customs, including the ancient deer dance that is combined with old Spanish church pageants.

YARD, a fundamental standard of length in the systems of measures in use in Great Britain and the United States, equal to three feet, or to thirty-six inches (see MEASURES). In the United States the yard (yd.) is defined in terms of the meter, which is the primary international standard of length; legally, the ratio of the yard to the meter is exactly 3600/3937. This amounts to saying that 1 meter = 39.37 inches, and that 1 yd. = 0.9144018 meter. The slightly smaller British Imperial yard, equal to 0.914399 meter, is defined as the distance between two scratches on a bronze bar kept at Westminster.

YARN is the thread or cord used in weaving or knitting a fabric. It is produced by spinning short textile fibers of cotton, flax, rayon, silk, or nylon, or by twisting together long filaments of silk, rayon, nylon, or some other synthetic. Yarns for making sheer fabrics or lace are usually very fine, while wool yarns for heavy garments are often thick. The yarn may be given twist as it is spun; twisting makes it stronger. Yarns made of more than one strand are described as 2-ply, 3-ply, or 4-ply yarns. Yarns for hand knitting are generally sold in one-ounce, two-ounce, or four-ounce skeins or balls. Because dyes often vary a little, many mills assign a number to each dye lot, or yarn that goes into the same dye bath. People buying yarn for hand knitting should check the numbers on the labels to see that all of the yarn is from the same dye lot. See also KNITTING; SPINNING; TEXTILES.

YAWS, a tropical disease caused by a microscopic, spiral-shaped organism called a *spirochete.* Although the spirochete of yaws closely resembles the spirochete of syphilis, yaws is not a venereal disease. It may attack human beings of any age but occurs most commonly in children. Direct contact with the skin discharges of infected persons and perhaps transmission by insects are the usual ways of acquiring the disease. About three to four weeks after the organisms have entered the body, a large, inflamed swelling, the so-called "mother yaw," appears at the site of infection. This is followed by the breaking out of raspberrylike sores in various parts of the body, sometimes accompanied by a slight fever, bone and joint pains, and loss of appetite and weight. Eventually the sores heal without treatment, but relapses occur often and the disease may persist for many years. Yaws can be cured by injections of penicillin or of drugs containing arsenic.

YAZ'OO RIVER, a river in western Mississippi formed by the junction of the Tallahatchie and the Yalobusha north of the cotton-shipping port of Greenwood. The Indians gave the river its name, which means *river of death.* The Yazoo winds its way to the south and southwest for about 190 miles to enter the Mississippi just above Vicksburg. Between the two rivers is a fertile flood plain known as the Yazoo Basin, or Yazoo Delta. River boats move up and down the river.



THE CALENDAR YEAR IS BASED ON THE SOLAR YEAR, which is shown in diagram form at the left. The diagram is very much exaggerated in order to show how the westward movement of the equinox, from A to B, brings the earth, the sun, and the equinox into line again a little before the earth completes its eastward journey around its orbit. The motion of the equinox does not affect the length of the sidereal year, which is diagramed at the right. In this case, both in the top and bottom diagrams, the sun, earth, and stars are in the same relative positions at the end of a sidereal year as at the beginning.

YEAR. According to our calendar, the 365 days from January 1 to December 31 make up one year. But if every year were only 365 days, the seasons and the months would not keep in step, because the seasons recur after about 365¼ days; thus December would shift gradually into autumn, and summer would be over by the Fourth of July (see SEASONS). For this reason, every year that can be exactly divided by 4 is made a *leap* year of 366 days. But even with this arrangement, seasons and months would get out of step in time; so a year ending a century is not a leap year unless it is divisible by 400. Thus 1972 and 2000 will be leap years, but 1900 and 1951 were not. See LEAP YEAR.

The *calendar* year is also called a *civil,* or a *legal,* year. Businessmen speak of a *fiscal* year, which is a calendar year that, for accounting or other purposes, begins on some other day than January 1.

The calendar year is based on the *tropical,* or *solar,* year, the year of the seasons. This tropical year is the period required for the sun to move from one equinox back to the same equinox again (see EQUINOX). More precisely, it is the period during which the sun, because of the eastward motion of the earth in its path, or orbit, *appears* to make a complete circuit of the heavens, also eastward, along a path called the ecliptic (see EARTH; ECLIPTIC). The tropical year contains 365 days, 5 hours, 48 minutes, 45.7 seconds, or 365.242196 mean solar days (see DAY;

Time, Measurement of). To keep the calendar year in step with the tropical year, its length is adjusted by means of leap years, as already described.

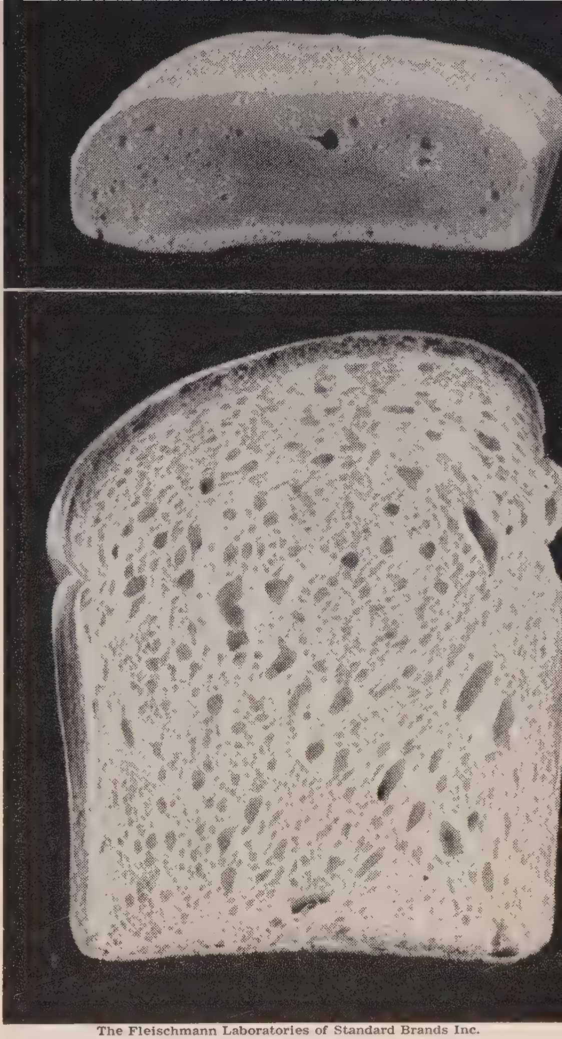
For astronomers, the tropical year is not the most exact year. They use the *sidereal* year of 365 days, 6 hours, 9 minutes, 9.5 seconds (365.256360 mean solar days). Mechanically this is the true period for the earth to make one complete revolution in its orbit around the sun. In this interval the earth makes one revolution in respect to the stars, and the sun seems to move from one position among the stars around to that same position again.

The tropical year is somewhat shorter than the sidereal year because the equinoxes through which the sun passes have a slow westward motion along the ecliptic. The sun, therefore, returns to a given equinox a little before it returns to the previous position of the equinox among the stars. (See Equinox, *Precession of the Equinoxes.)* In 1952 the International Astronomical Union recommended that the sidereal year be adopted as the standard of time instead of the mean solar day, because the earth's rate of rotation is slowing down gradually and also varies in an unexplained and irregular manner.

There is also the *lunar* year of twelve months — that is, twelve cycles of the moon's phases. Among the religious calendars based on this lunar year are the Mohammedan year of 354 days and the Jewish ordinary year of 353, 354, or 355 days or intercalary year of 383, 384, or 385 days. See Calendar; Month.

YEAST, a simple one-celled plant belonging to the group of plants known as fungi. Yeasts are contained almost everywhere in the air and normally are found on fruits and berries in orchards, gardens, and woodlands. A few kinds live on or in the bodies of man and animals, producing various kinds of diseases. Yeast-caused diseases are especially common in the tropics.

Nature of Yeast Cells. Since they are invisible to the naked eye, yeast cells must be studied under a microscope. Somewhat larger than bacteria, they are oval or round in shape and occur either singly or in small colonies. Because they do not contain chlorophyll, they cannot manufacture their own food and therefore get food mainly from nonliving organic matter (see Chlorophyll). Yeasts reproduce in two ways — by budding or by the formation of spores. In budding, the cell nucleus divides and one half of the nucleus moves to the side of the cell, where a small lump or bud begins to swell out. The bud, with its enclosed nucleus, becomes larger and larger. Eventually, it either breaks loose, forming a new independent cell, or remains attached to start a colony. Under unfavorable conditions, such as lack of food or moisture, the yeast cell divides into four new cells. These cells, known as *ascospores*, are not set free but remain protected within the cell wall of the parent cell. With the return of favorable conditions, the ascospores grow, burst through the cell wall, and become free-living yeast cells.



The Fleischmann Laboratories of Standard Brands Inc.

THE DRAMATIC EFFECT OF YEAST is shown in these pictures of baked bread which has no yeast for leavening (above) and baked bread which has been leavened with yeast (below).

Uses. To obtain food and energy, yeasts break down chemically the starches and sugars contained in various substances, thus producing alcohol and carbon dioxide. It is this reaction that accounts for the important role of yeasts in the production of commercial ethyl alcohol, in the fermentation of wine and beer, and in the "rising" of bread. When grapes are crushed for wine the yeasts found so abundantly on the skin of the fruit act on the sugar in the fruit juices to form wine containing alcohol and carbon dioxide. Similarly, the yeasts in bread dough act on the starches in flour, producing carbon dioxide bubbles, which make the dough porous,

The Museum of Modern Art

THIS DRAWING OF THE POET Yeats as a young man was done in charcoal by John Singer Sargent.

or light; and alcohol, which evaporates during the baking of the bread. See BEER; BREAD; FERMENTATION; WINE.

The yeasts that float in the air and are found on fruits are "wild" yeasts. Several different strains live on grapes and are partly responsible for the characteristic flavors of different wines. The yeasts used in making bread and brewing beer are "cultivated" yeasts. They have been carefully developed to produce the desired flavors and uniform, reliable action and are closely guarded against contamination by wild yeasts or other undesirable organisms. Several kinds of yeasts are produced commercially. *Compressed* yeast, familiar to most housewives, is made by cultivating special strains of yeasts in a sugar solution prepared from a grain mash. When enough yeast has formed on top of the solution, it is skimmed off, starch is added, and the water is pressed out. The yeast is then cut into cakes and wrapped for distribution. In preparing *dry* yeast, the starch is omitted and the cultured yeast is dehydrated, or dried, at low temperatures. Compressed yeast is quicker acting than dry yeast, but, unlike dry yeast, it will keep for only a short time. *Brewer's* yeast, a type of dry yeast, is obtained as a by-product in the fermentation of beer and ale. Yeast is a good source of the B vitamins.

YEATS, *yates,* WILLIAM BUTLER (1865-1939), Irish poet, playwright, and essayist, was born near Dublin. He was the son of the artist J. B. Yeats. The family soon moved to London, but Yeats in his boyhood went often to Sligo, the home of his mother's family. After a brief venture into the study of painting, he took up poetry. The movement known as the Irish Literary Revival was then getting started. One of its first publications, an anthology called *Poems and Ballads of Young Ireland,* which appeared in 1888, contained four poems by Yeats. A year later his first book, *The Wanderings of Oisin and Other Poems,* came out. These poems showed Yeats's interest in Irish folklore, Irish legends, scenes, and history. This book and the volumes that followed *(The Countess Cathleen* and *The Wind Among the Reeds)* gave Yeats a considerable reputation. After about 1914 his verse began to place less emphasis on local color and conventionally beautiful language, and more emphasis on wittily intellectual statement in language that suggested everyday speech. The new style became apparent in *Responsibilities* and *The Wild Swans at Coole,* and it was developed further in *The Tower* and *The Winding Stair.* Another aspect of Yeats's later poetry is its increasing use of a mystic symbolism which he explained in *A Vision.*

In the field of the drama Yeats did not achieve the supremacy among modern Irish writers that he enjoyed as a poet. But he was intensely interested in the theater. Aided by Lady Gregory and others, he founded the Irish Literary Theater in Dublin in 1899. Yeats was a director of the famous Abbey Theater. His plays, in prose and verse, are *The Shadowy Waters, Kathleen ni Houlihan, The Hour Glass, On Baile's Strand, Deirdre,* and *The Green Helmet.* He also published in 1921 a group of unusual dramas called *Plays for Dancers.* Yeats received the Nobel prize for literature in 1923. See also IRISH LITERATURE.

YELLOW, in pigments, is one of the three primary colors (red, blue, yellow) from which all the other colors can be made. There are many different hues of yellow, ranging from the cool lemon yellows, which contain some green, to the warm yellows that are close to orange. In the spectrum made by passing a beam of white light through a prism, yellow comes between red and green. In wave length the yellows range approximately from 585 to 575 millimicrons. Yellow is not considered one of the primary colors of light, because a mixture of red light and green light striking the eye creates an impression of yellow. See also COLOR; ELECTROMAGNETIC RADIATION; FREQUENCY; LIGHT.

YELLOW FEVER, an infectious disease of man and certain animals, is caused by a filtrable virus. The virus is carried by infected mosquitoes (known to scientists as *Aedes aegypti)* which inject it into the victim's blood stream while biting. Until it was brought under control by modern science, yellow fever was once widely prevalent in the tropical and semitropical regions of the

American and African continents. It occurred in great epidemics, killing thousands and thousands of people. Today, owing to doggedly persistent study and heroic sacrifice, even of life itself on the part of certain physicians and their volunteer assistants, yellow fever has been stamped out in civilized areas. A type known as jungle yellow fever still survives, however, in the interior of Africa and Central and South America. It is transmitted not only by *Aedes aegypti* but also by many other species of mosquitoes.

At one time it was believed that yellow fever was caused by unsanitary conditions and could be transmitted from person to person by contact. In 1854 Beauperthuy put forth the theory that the disease was transmitted by a mosquito of the "striped variety" *(Aedes)*, and the same theory was advanced by Dr. Carlos Finlay in 1881. But it was not until twenty years later that this theory was proved.

In 1900, in an effort to establish once and for all the means by which yellow fever is transmitted, Dr. Walter Reed, aided by Dr. James Carroll and Dr. Jesse Lazear, headed an expedition of the United States Army Yellow Fever Commission to Cuba, where the dread disease was rampant. Here experiments were made on volunteer soldiers and certain members of the commission, who allowed infected mosquitoes to bite them in order to determine whether yellow fever was transmitted in this way. As a result, several persons became ill of the disease, among them Dr. Carroll. Later, while conducting other experiments, Dr. Lazear allowed a mosquito that happened to land on his arm to bite him and paid for the test with his life. Other cases of yellow fever were produced by injecting the blood and blood serum of infected patients into healthy persons.

To prove further that mosquitoes rather than unsanitary conditions were responsible for yellow fever, Dr. Reed used two groups of volunteer soldiers. One group lived in a filthy but mosquito-proof cabin and used blankets, clothes, and cooking utensils that had been used by yellow-fever victims. Not a man of this group contracted yellow fever. Members of the other group were put in an unscreened cabin under conditions of good sanitation but with no protection against mosquitoes. All came down with the disease. After only seven months' work the commission had achieved its goal, and the United States was then able to set up mosquito-control measures in the Panama Canal Zone and in other areas under military jurisdiction. By freeing the area from this terrible fever the work of the commission made possible the construction of the Panama Canal.

As its name implies, yellow fever produces a yellowing of the skin, or jaundice. This condition is due to virus destruction of the liver. The early symptoms of yellow fever, occurring three to six days after the mosquito has bitten, come on suddenly and include headache, fever, backache, nausea, and vomiting. By the fourth day the skin is badly jaundiced. The pulse rate falls, and all material vomited or excreted becomes black with altered blood. Death, if it occurs, usually takes place between the sixth and ninth days. If the patient lives, he is immune to the disease for life.

Since there is no specific cure for yellow fever, treatment consists mainly in attempting to alleviate the patient's symptoms with various drugs. The disease is controlled by maintaining a strict international quarantine on ships and airplanes coming from yellow-fever areas, by eliminating the places where mosquitoes can breed, and by immunizing with vaccines all persons traveling to and from areas where yellow fever might be present. See also MEDICINE; REED, WALTER; VIRUS.

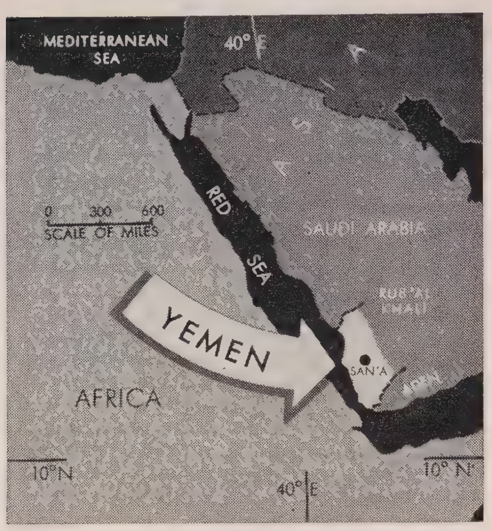
YELLOW JACKET. See WASP.

YELLOWLEGS. See SANDPIPER.

YELLOW RIVER (in China). See HOANGHO, or HWANG HO.

YELLOWS, diseases that cause the leaves of plants to turn yellow wholly or in part. Yellowing of leaves may be caused by insect attacks or other mechanical injury to the plant, by a lack or an excess of water, by a deficiency of nitrogen or other essential element in the soil, by too alkaline a soil, and by bacterial, virus, and fungus diseases. The diseases specifically called yellows are caused chiefly by viruses and fungi (see FUNGI; VIRUS). Peach yellows, lettuce yellows, onion yellows, and yellows of aster are virus diseases. Yellows of cabbage, celery, and gladiolus are caused by parasitic fungi. Nothing can be done for plants affected with virus and fungus yellows. They should be rooted out and destroyed. Some protection may be given to other susceptible plants by controlling the insects that transmit some kinds of yellows. But yellows organisms may live on in the soil for years, making it impossible to grow the susceptible plants. See also DISEASES OF PLANTS.

YELLOW SEA, an arm of the Pacific Ocean extending west of Korea and south and east of northeastern China. It is four hundred miles long and about the same distance wide. South of the Yellow Sea is the East China Sea, and to the northeast, through the Korea Strait, is the Sea of Japan. The Yellow Sea cuts deepest into the continent of Asia in the Gulf of Po Hai, on which is situated the great Chinese city of Tientsin. Other ports on the sea include Inchon, in



FROM THE ARAB KINGDOM OF YEMEN fine coffee is shipped to importers all over the world.

Korea, and the Chinese cities of Dairen, Port Arthur, Chefoo, and Tsingtao. The Yalu, Liao, Yellow (Hwang Ho), and other rivers flow into the Yellow Sea, which gets its name from the great quantities of yellow mud carried downstream by some of these rivers. See also China.

YELLOWSTONE NATIONAL PARK. See Parks, National.

YELLOWSTONE RIVER, one of the principal tributaries of the Missouri, rises in the mountains of northwestern Wyoming, flows northward through the rocky canyons of Yellowstone National Park, and turns to the northeast to cross Montana, joining the Missouri in North Dakota, close to the Montana line. The Yellowstone is about seven hundred miles long. The Bighorn, the Tongue, and the Powder flow into it from the south. See also Missouri River; Montana; Parks, National.

YELLOWTHROAT. See Warbler.

YEM′EN, a kingdom on the heel of the boot-shaped Arabian peninsula in southwestern Asia, has the Red Sea as its western boundary. To the south and southeast is the Aden Protectorate, to the northeast the vast desert called Rubʻal Khali, and to the north Saudi Arabia. Yemen, with an area of 75,000 square miles, includes a dry coastal plain, where sheep, goats, and camels are raised, and interior highlands, which produce coffee, wheat and other grains, vegetables, and such fruits as grapes, apricots, dates, and citrus fruits. Much of the inland region is cool and, unlike other sections of the peninsula, fairly well supplied with rain. The mountains of Yemen rise to altitudes of 10,000 and 12,000 feet.

A king rules with absolute authority over the 4,500,000 inhabitants of Yemen. Most of the people are Arabs of the Moslem faith. The inland walled city of Sanʻa is the capital, and Taʻizz is the site of the royal residence. Hodeida is the chief port. Yemen's Mocha coffee is world-famous, and hides and grain are also exported. Textiles, and daggers made from local ore, are among the products of native craftsmen. Although there are some motor roads and a few power plants, Yemen remains a primitive country where camel caravans continue to travel over ancient trade routes. Not until after World War II were foreign experts invited to aid the country in its attempts to improve its economy and the health of the people.

Centuries before Christ, kingdoms flourished in the territory now occupied by Yemen. Egyptian, Ethiopian, Roman, and Turkish armies invaded the region, and both Egypt and Turkey held it for considerable periods. From the fourth century until after the founding of modern Israel, there was a fairly large Jewish population. British influence in Yemen was strong in the twentieth century, and in 1934 Britain guaranteed Yemen's independence. In that year the boundary lines between Yemen and Saudi Arabia were officially established. Yemen joined the Arab League in 1945 and the United Nations in 1947. See also Arabia.

YEN, the monetary unit of Japan. When Japan adopted the gold standard in 1897, the yen was worth about fifty cents in United States money. Its value in terms of the dollar was about twenty-three cents before World War II. After the war the yen was temporarily fixed at 360 to the dollar. Its value at a given time can usually be found in the foreign-exchange rates published in the daily newspapers. The yen was coined in 20-yen, 10-yen, and 5-yen gold pieces, and in 50-yen, 20-yen, and 1-yen silver pieces, but these were discontinued. Banknotes come in denominations of 5, 10, 20, 100, and 1,000 yen, and coins worth 5 yen and one yen are in circulation. The yen is divided into 100 sen. It is written ¥.

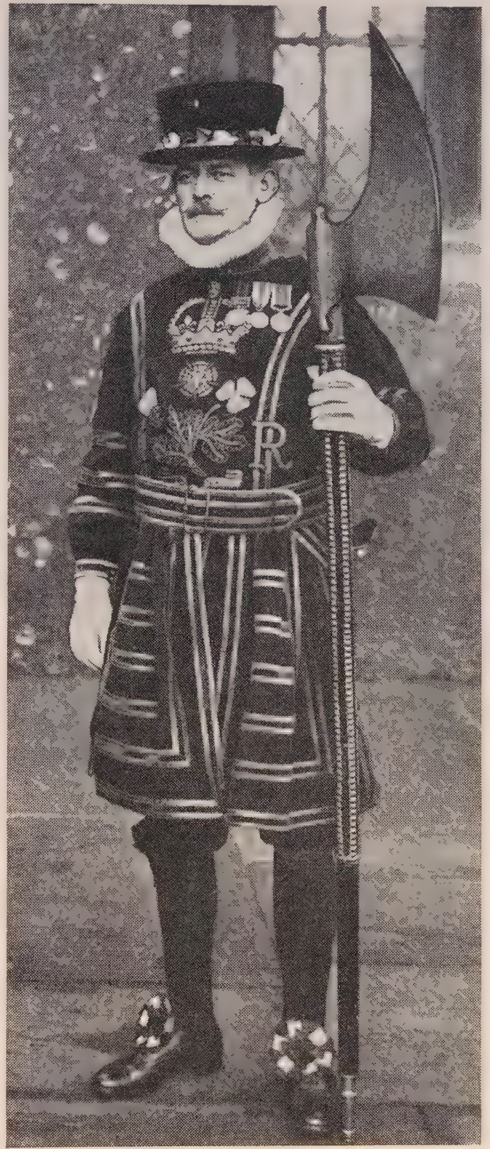
YENISEI, *yen ih sa′*, **RIVER**, one of the chief rivers of Siberia, in Soviet Asia, rises in the mountains of Outer Mongolia and flows generally northward to empty into the Arctic Ocean, a distance of more than 2,500 miles. Like the Ob to the west and the Lena to the east, the Yenisei is the principal north-south highway of its region. It is navigable as far as Minusinsk, near the border with Mongolia, and it is frequently more than a mile wide and at least fifty feet deep. It passes through a vast forest, rich in both softwoods and hardwoods. Lumbering is the main occupation of the people who live in the towns and villages scattered along the course of the river. The Yenisei has three main tributaries, the Lower Tunguska, the Stony Tunguska, and the Upper Tunguska, or Angara, which flows out of Lake Baikal. From the source of the Angara to the mouth of the Yenisei is 3,553 miles. The basin drained by the Yenisei and its tributaries is probably more than a million square miles in area. The river is frozen for at least six months of the year. See also ASIA (map); BAIKAL, LAKE; MONGOLIA; SIBERIA.

YEOMAN, *yo′ man,* in England, a freeholder, or small farmer. In medieval times a servant, or attendant, with lowly duties was called a yeoman, but after 1500 the term applied to those stouthearted farmers of England who worked their fields in time of peace and left them in time of emergency to fight valiantly for the land they loved. Beginning in the late eighteenth century, volunteer cavalry troops of yeomen, under the command of the local gentry, or big landowners, became an important part of Britain's military system. The Yeomen of the Guard, sometimes called "Beefeaters," were organized in 1485 as the official bodyguard of the British sovereign. In the navy a yeoman is a petty officer whose duties are chiefly concerned with clerical work.

YER′KES OBSERVATORY. See OBSERVATORY.

YEW, a large family of slow-growing, long-lived, coniferous shrubs and trees (see CONIFERS). Yews have flat, needlelike leaves that form two rows along the twig. Their cones look like bright-red berries. The somber *European* yew, common in English churchyards, has been a symbol of death and mourning since ancient times, and because of its long life, which may be more than a thousand years, it has also symbolized eternal life. The English longbows were made of its tough wood. The *Pacific* yew, a small tree, grows from Alaska to Idaho. Its wood is used to make bows, paddles, and small articles of furniture. The *Canada* yew, or *ground hemlock,* usually only two or three feet high, grows in southeastern Canada and the northeastern United States. The *Florida* yew, a small tree, is confined to western Florida.

YGGDRASILL, *ig′ druh sil,* in ancient Norse legend, the tree of life and knowledge. It was an enormous ash tree with three great roots. One reached to Jotunnheim, the home of the evil giants; another touched Asgard, the home of the gods; and under the third was Niflheim, the abode of the dead.



Brown Brothers

YEOMEN GUARDS OF THE TOWER of London still wear the traditional costume of olden times.

YIDDISH LANGUAGE AND LITERATURE. Yiddish, a folk language of the Jewish people, developed in medieval times in Germany. It is like German, but it also contains Hebrew and Slavic words and constructions. The Yiddish spoken in the United States shows a strong English influence. Yiddish words and expressions like *kosher* and *mazuma* often appear in English speech. For a long time Yiddish was primarily a spoken language. The early written literature was mostly religious. Translations of the Bible, prayer books, and other works on religious subjects were put into Yiddish for the many people who did not know Hebrew, the language of the scholars. Eventually the literature in the popular tongue included songs, plays, poems, folk tales, and legends.

Although influential writers like Jacob

Brown Brothers

THE HOUSE OF YORK won a great victory over the House of Lancaster at the Battle of Tewkesbury in 1471, during the Wars of the Roses.

Ashkenazi appeared earlier, the nineteenth century was perhaps the golden age of Yiddish literature. S. Y. Abramowitz (1836-1919), who wrote under the name of Mendele (Mocher Sforim); Y. L. Peretz (1852-1915); and the humorist Shalom Rabinowitz (1859-1916), whose pen name was Sholem Aleichem, were the outstanding authors. Through translations, such authors as Sholem Asch (1880-) have won international reputations. The Yiddish theater has had great success in the United States and in parts of eastern Europe. Yiddish is spoken by some five million people who live principally in Russia, other countries of eastern Europe, and the United States. There are a number of Yiddish newspapers and journals in the United States.

YMCA. See Young Men's Christian Association.

YO'HO NATIONAL PARK. See Parks, National.

YOKOHAMA, *yoh koh hah' muh,* Japan, an industrial city and the port of Tokyo, is on the western shore of Tokyo Bay, a few miles south of the capital city. Yokohama is actually a part of metropolitan Tokyo, for the region between the two cities is thickly settled. An electric railroad provides quick and frequent interurban service. As a port, Yokohama is second to Kobe in volume of shipping. These two ports are ranked among the leading world ports. Yokohama, as the port nearest to the North American continent, handles much of the trade between the United States and Japan. Silk is one of the principal products of the Kwanto Plain, the large area of level land spreading fanwise around Tokyo and Yokohama, and much of the silk shipped to the United States passes through the port. Yokohama is a modern city in appearance, for it was rebuilt after the disastrous earthquake of 1923. The air raids of World War II damaged the city severely, but reconstruction began as soon as the war ended. Yokohama has many different industries, from shipbuilding to silk weaving. Machinery and electrical goods are manufactured, for the most part in small workshops. The population is about 950,000. See also Japan; Tokyo.

YOM KIPPUR, the Hebrew Day of Atonement, is the most sacred day in the Jewish calendar. It occurs ten days after Rosh Hashana, the New Year, and is observed with fasting and prayer. Hardly a Jew who follows the faith misses attendance on this day at a house of worship, where the prayers center upon repentance for past shortcomings and vows are made that good deeds shall be performed in the future. "Repentance, Prayer, Good Deeds," declares the Yom Kippur liturgy, "avert the severest decree!" The future day is ushered in with the haunting melody of "Kol Nidre" and concludes at dusk twenty-four hours later with the sounding of the Shofar, or ram's horn. Before the ancient Temple at Jerusalem was destroyed in A.D. 70, the Day of Atonement was observed there. According to Hebrew law, on this day "ye shall afflict your souls: ye shall not do any work therein" (Num. 29:7). Leviticus 16 describes the ancient ritual of the sin offering, the sprinkling of blood, and the "atonement for the holy sanctuary . . . for the tabernacle . . . for the altar . . . for the priests, and for all the people." See also Judaism.

YONKERS, *yong' kurz,* N. Y., an industrial and residential suburb located on the east bank of the Hudson, fourteen miles north of the heart of New York City. Factories, mills, and warehouses line its waterfront; eastward, along a series of terraces and hills, lie attractive residential districts. Elevators, carpets, hats, dresses, electrical goods, machinery, food products, iron and steel products, and drugs and chemicals are its chief manufactures. It is the site of Sarah Lawrence College for women, St. Joseph's Seminary, and the Boyce-Thompson Research Institute, which conducts studies in plant life. Among its historical buildings are Philipse Manor Hall, dating from colonial times and preserved as a state museum, and "Greystone," once the home of Samuel J. Tilden. The site of Yonkers was included in a grant made to Adrian van der

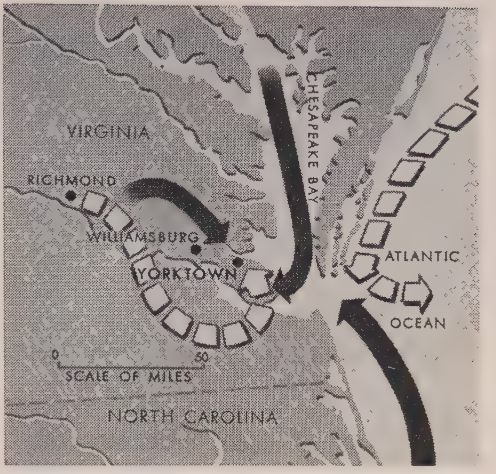
Donck in 1646. The grant was known as "De Jonkheer's land," from which the name Yonkers is derived. Yonkers was incorporated as a village in 1855 and as a city in 1872. Its population is about 153,000.

YORK, England, a city in Yorkshire about 180 miles north of London, on the Ouse and Foss rivers, is an industrial center and the seat of an archbishopric second only to Canterbury. It also has a long and colorful history. Called Eboracum by the Romans, who made it a military base, it later became the capital of Northumbria, the site of a castle built by William the Conqueror, an early center of learning, and, in the Middle Ages, a famous producer of glass and textiles. Today York is an important railroad hub for industrial Yorkshire. There are model factories for the manufacture of chocolate, and stained glass is still made there. Fourteenth-century walls form a promenade around part of the old city, and across the river is a modern garden suburb. York Minster (the Cathedral of St. Peter) was founded in 627, but the present church, with its magnificent stained glass, was originally built in the twelfth century. The population is about 108,000.

YORK, House of, an English royal house which furnished three kings of England — Edward IV, Edward V, and Richard III. This royal house was descended from the first Duke of York, Edmund Langley, who was the fifth son of Edward III. When Richard II, the son of Edward III's eldest son, was removed from the throne in 1399, Edmund, Earl of March, the eldest descendant of Edward's third son, was too young to become king. Instead, the crown passed to Henry IV, a son of John of Gaunt, the fourth son of Edward. Henry was the first of the House of Lancaster to reach the throne.

Henry VI, grandson of Henry IV, was mentally unsound. During his reign England suffered defeat in the Hundred Years' War, and there were troubled times at home. A leader of the barons who rose up against Henry was Richard Plantagenet, third Duke of York, whose father was a son of Edmund Langley and whose mother was the sister of the Earl of March. Richard claimed the throne by reason of being closer to the line of direct descent than members of the House of Lancaster. The Houses of York and Lancaster, whose symbols were respectively a white and a red rose, then clashed in the Wars of the Roses.

Richard was killed in 1460, but in 1461 his son Edward defeated the Lancastrian forces and became king as Edward IV. He died in 1483. Thirteen-year-old Edward V, his son and successor, was murdered by the boy's uncle, Richard of Gloucester, who took the throne as Richard III. In 1485, at the Battle of Bosworth Field, the Earl of Richmond, a direct descendant of John of Gaunt, defeated Richard and became king as Henry VII. To unite the Houses of York and Lancaster and to bring an end to the Wars of the Roses, he married Elizabeth of York, daughter of Edward IV. As the son of Edmund Tudor, he founded the Tudor line. See also England, *History;* Lancaster, House of; Plantagenet; Roses, Wars of the.



THE TRAPPING OF CORNWALLIS is diagramed on this map. The movement of British troops and ships is indicated by the broken white lines and arrows, while the solid black lines and arrows represent the encircling tactics of the American and French land and sea forces.

YORK, Pa., an industrial city in an agricultural belt, is situated ninety-six miles west of Philadelphia. York's heritage from Revolutionary times is preserved in its handsome old buildings as well as in the history books. Today the city manufactures a variety of products, including equipment for refrigeration and air conditioning, textiles, farm machinery, fertilizers, processed foods, cigars, paper products, water turbines, bank safes and vaults, and auto bodies. Large markets handle the produce of the surrounding farmlands. The city has a symphony orchestra, a Little Theater, and a junior college. York was laid out in 1741 and has been the seat of York County since 1749. The grain-growing region around it was the breadbasket of colonial America. The Continental Congress transferred its sittings to York from Philadelphia in September, 1777, and remained in York until June, 1778. There it approved the Articles of Confederation, printed money on one of Benjamin Franklin's presses, and otherwise carried forward the business of the infant nation. York became a city in 1887. Its population is about 60,000.

YORKTOWN CAMPAIGN, the military

Church of Jesus Christ of Latter-day Saints

MORMON LEADER BRIGHAM YOUNG was largely responsible for the establishment and development of the settlement at Salt Lake.

maneuvers around Yorktown, Va., which resulted in the surrender of a British army under General Cornwallis on October 19, 1781, and brought an end to major military action in the American War for Independence. The surrender was made to a combined French and American force at Yorktown, which is on the York River and near the entrance to Chesapeake Bay.

Cornwallis had been making important gains in the South since early in 1780. Although British forces suffered setbacks at Kings Mountain and Guilford Courthouse in the Carolinas, he was able to join forces with troops under Benedict Arnold and drive against Richmond and Charlottesville, in Virginia. The French general, Lafayette, opposed him, but the British army of veterans was in excellent condition when Cornwallis established it at Yorktown in August, 1781. With his seven thousand men dug in behind strong defenses, the British commander confidently awaited naval support. His position did not seem especially dangerous even when Lafayette took up a position at Williamsburg, blocking the escape route from Yorktown inland.

During this period, in the North, Sir Henry Clinton directed British control of New York, and General George Washington commanded the patriot army in the area. But Washington had at last secured the French aid he needed, and with the French leader Rochambeau, he slipped away from New York and led the combined forces southward. At the end of August, French naval units brought reinforcements to Lafayette and took control of the waters around Chesapeake Bay. The French fleet under the Admiral Comte de Grasse, which had sailed from the West Indies, prevented an attempt by the British navy to aid Cornwallis, who was now trapped. (See map on preceding page.)

After their long march, Washington's troops were shipped down Chesapeake Bay, and by the end of September, the allied forces, numbering over 16,000 men, were ready to begin the assault on the British at Yorktown. For three weeks Cornwallis withstood the siege; but sharp assaults broke through his outer defenses, his supplies ran low, and hope of aid gradually vanished. On October 19 he surrendered 7,247 men, with arms, horses, equipment, and money. Although the treaty of peace was not signed for two years, Yorktown marked the end of the war on the continent. As a combined operation of allied land and sea forces, the Yorktown Campaign will always hold an important place in military history.

See also Arnold, Benedict; Clinton, Sir Henry; Cornwallis, Charles, First Marquis; Kings Mountain, Battle of; Lafayette, Marquis de; Revolutionary War in America; Rochambeau, Comte de.

YOSEMITE, *yoh sem' ih tee,* **NATIONAL PARK.** See Parks, National.

YOUNG, Brigham (1801-1877), the successor of Joseph Smith as head of the early Mormon Church, was born on his father's farm in Whitingham, Vt. The family moved to western New York in 1804. Brigham Young was a farmer, painter, and glazier as a young man. He was interested in religion and at twenty-two joined the Methodist Church, but after studying *The Book of Mormon,* which Joseph Smith published in 1830, he was converted to the new religion proclaimed by Smith. He entered the Church of Jesus Christ of Latter-day Saints in 1832 and went out to Kirtland, Ohio, with a group of Mormons. He became a missionary and organizer of the Church and soon was appointed one of the ruling council, the Quorum of the Twelve Apostles.

Brigham Young worked closely with Smith during the years when the Mormons were driven from place to place in their search for a permanent home, and after Smith's death at the hands of a mob Young took his place as leader of the Church. He was chiefly responsible for the Mormon migration to the Great Salt Lake Valley, and he worked out the economic and social plans that made Deseret (Mormon name of the colony) a permanent success. He was an autocratic and very able ruler of the Mormon society, and when Deseret became Utah Territory he served as its first governor. Even after leaving office he continued to wield the real power in Utah. According to the Mormon practice in early days, he made many marriages, and he had fifty-six children. See also MORMONS; SMITH, JOSEPH; UTAH, *History*.

YOUNG, CHARLES AUGUSTUS (1834-1908), American astronomer, was born in Hanover, N. H., and was educated at Dartmouth College. After teaching at Western Reserve College in Ohio and at Dartmouth, he went to Princeton in 1877 and remained there until his retirement in 1905. Young was a remarkable teacher and the author of many excellent textbooks on astronomy. He did pioneer work in the study of the sun by means of the spectroscope, organized several expeditions to observe total solar eclipses, and made many other contributions to scientific knowledge.

YOUNG MEN'S CHRISTIAN ASSOCIATION (YMCA), an organization devoted to the training of young men in Christian fellowship, good citizenship, and health, has more than 4,000,000 members and maintains some 10,000 branches in more than 75 countries. There are about 1,800 local associations in the United States and 95 in Canada, along with some 13,000 clubs for high-school students.

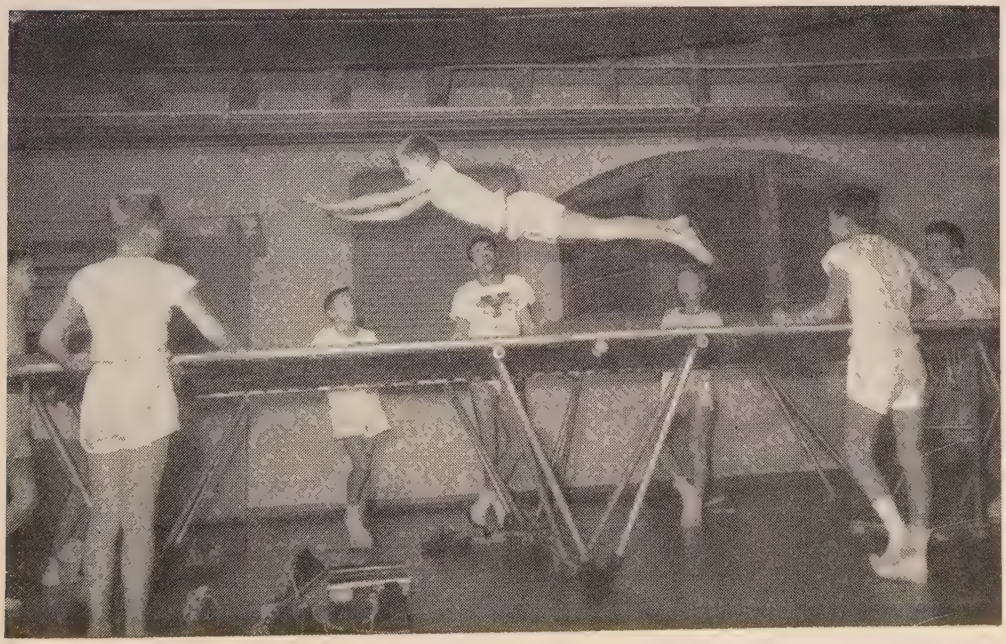
In many cities the YMCA maintains residences where young men can live at moderate cost. Gymnasiums and swimming pools are open to members, and many YMCA's offer regular school courses leading to a diploma. Informal educational work through discussion groups, camping programs, organized recreation, and vocational guidance and counseling are part of the services provided by the YMCA. In time of war special services are offered to members of the armed forces. The YMCA was one of the principal agencies of the United Service Organizations (USO) during World War II.

The Young Men's Christian Association was founded in London in 1844 by a group of young men who worked in a drapery firm and lived on the company premises. Their leader was George Williams, who later became a prominent businessman and was knighted by Queen Victoria. The purpose of the association was to bring their fellow workers into a friendly circle with a religious basis. The movement spread rapidly. The first North American YMCA's were organized in 1851, in Montreal and Boston. After 1889, trained leaders from North America helped to establish YMCA centers in the Orient, the Near East, and Latin America.

YOUNGSTOWN, OHIO, a great center of steel production, is located in the Mahoning Valley of northeastern Ohio. It is the hub of a twenty-five-mile chain of steel mills along the Mahoning River. Iron ore is shipped to Youngstown from the Lake Superior mining region, and some iron, as well as coal and limestone, is mined in the Mahoning

YOUNGSTERS BOUNCE ON A TRAMPOLIN at their local "Y," under the supervision of a trained instructor.

YMCA of Chicago



National Board, YWCA

YOUTHFUL MEMBERS OF THE YWCA climb a fence in their eagerness to begin a hike in the woods.

Valley. Practically all the city's industries are associated with the making of iron and steel products. Railroads, truck lines, and airlines serve busy Youngstown. Many of the workers in its factories are of Slovak, Slovene, Polish, and Italian origin or descent. In outlying areas there are charming residences and estates, and the surrounding countryside is a rich agricultural region. Youngstown College, Butler Art Institute, and the Reuben McMillan Free Library are the city's leading cultural centers. Mill Creek Park, with its two thousand acres of natural beauty, is threaded by ravines, gorges, and lakes. The site was settled in 1796 when John Young purchased land from the Connecticut Land Company. Incorporated as a town in 1848 and as a city in 1867, it became the seat of Mahoning County in 1876. The population is about 168,000.

YOUNG WOMEN'S CHRISTIAN ASSOCIATION (YWCA), an international organization whose purpose is to advance the physical, social, intellectual, moral, and spiritual growth of young women. The following statement of purpose forms the basis of membership in the organization: "To build a fellowship of women and girls devoted to the task of realizing in our common life those ideals of personal and social living to which we are committed by our faith as Christians. In this endeavor we seek to understand Jesus, to share His love for all people, and to grow in the knowledge and love of God." Any girl over twelve may become a member, regardless of class, creed, or racial origin. Any woman or girl of seventeen or over who subscribes to the YWCA purpose quoted above may become a voting member.

Activities include Christian observances, clubs and forums, classes in homemaking, vocational training, health education, recreational opportunities through games, dancing, arts and crafts, music, and sports, and community services such as camping, housing, rooms registry, and counseling. The American YWCA's chief annual events are National YWCA week, held each year in the last week in April; annual Y-Teen Roll Call Week, observed the middle of October; World Fellowship Week, in the middle of November; and various student assemblies, Y-Teen, YW Wives', and Business and Professional Girls' conferences.

The first YWCA was founded in England in 1855. There are now Associations in sixty-five countries. Association work began in the United States in 1858, and the movement spread until today there are hundreds of community and campus YWCA's and over a thousand village and rural units. The total membership in the United States alone is over three million. The local Associations in all countries are self-governing. In America, the National Board acts as the link between the local Associations and YWCA's of other lands and also represents the American units as affiliated with the World's YWCA, which has its headquarters in Geneva, Switzerland.

YOUTH HOS'TEL, an inexpensive, simple lodging place for young people traveling on

British Information Services

BRITISH CYCLISTS CHECK each other's tires as they set out from a youth hostel to begin the next lap of their journey.

foot, on bicycles, on horseback, by canoe, or by skis. The purpose of the youth hostel movement is to encourage healthful outdoor recreation, good fellowship, and mutual understanding between people of different nations and races. In the United States, Canada, and many other countries, hostel associations, which are nonprofit, educational agencies, establish hostels and arrange guided trips under trained leaders. The national associations are independent, though they are members of the International Youth Hostel Federation. Membership in one association carries with it the privilege of using hostels in other countries. There are many hostels in Europe where young travelers from other parts of the world are welcomed. There is no age limit for membership, but each member must be able to walk at least twelve miles a day or do thirty miles on a bicycle. On long trips some of the travel is by public transportation. Most of the hostels have cooking and laundry facilities, bunk rooms, and simple kitchen equipment. Houseparents supervise the hostel, but the hostelers cook their own meals and clean up before they leave. Where no hostels are available, the group usually camps out.

YSAYE, *e′ za e′*, EUGÈNE (1858-1931), Belgian violinist and conductor, was born in Liége. He received his early musical training at Liége Conservatory and later he studied with noted violinists of the day. His playing was distinguished by a highly original technique and he performed with sensational success in both Europe and America. He also achieved fame as a conductor and an ensemble player and founded and led the Ysaye Concerts in Brussels. From 1918 to 1922 he was conductor of the Cincinnati Symphony Orchestra. He gave many sonata recitals with the French-Italian pianist, Raoul Pugno, and also headed a distinguished string quartet. His works, chiefly for the violin, include six violin concertos. From 1886 to 1898 Ysaye was professor of violin at the Brussels Conservatory.

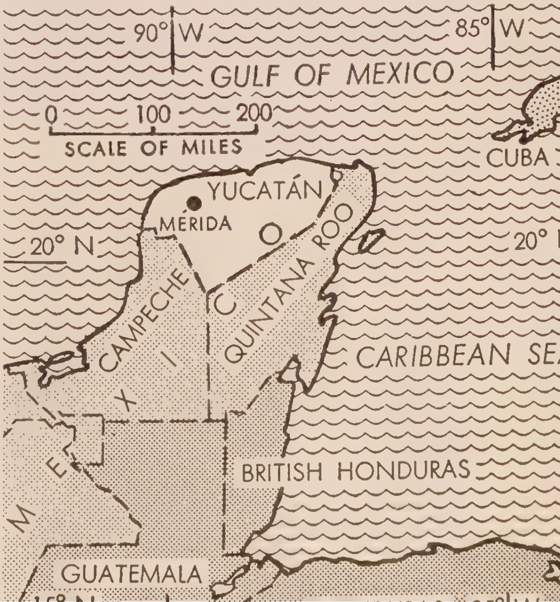
YTTERBIUM, *ih tur′ bih um,* a chemical element belonging to the rare-earth metals of Group 3 in the periodic table of the elements (see PERIODIC TABLE). Since these metals and their compounds are very difficult to separate from one another, commercial uses have been developed chiefly for the mixtures. The substance named ytterbium in 1878 by its discoverer, the Swiss chemist Marignac, was found (1907) by G. Urbain to consist of two elements, now called ytterbium and lutetium. They occur in the rare-earth minerals found in monazite sands. See THORIUM.

The chemical symbol for ytterbium is Yb, atomic number 70, atomic weight 173.04, specific gravity 7.0, and melting point about 1800° C. (3272° F.). In some compounds, like the trichloride, the oxide, the acetate, and the sulfate, ytterbium has a valence of + 3 (see CHEMISTRY); in the dichloride, ytterbous sulfate, and other compounds its valence is + 2.

YTTRIUM, *it′ rih um,* a metallic chemical element that belongs in Group 3 of the periodic table of the elements (see PERIODIC TABLE). Though not one of the rare-earth metals of Group 3, it is often called one because it is always found with them in their ores and is so like them in chemical properties that it has been difficult to isolate, even in small quantities. For this reason no commercial uses for it have been developed. The massive metal can now be obtained with a high degree of purity and large yields by a method announced in 1952. It was previously obtained as a dark-gray powder and as small iron-gray scales with a metallic luster. Yttrium has the atomic number 39, atomic weight 88.92, melting point about 1490° C. (2714° F.), and a valence of + 3 (see CHEMISTRY); its chemical symbol is Y. The oxide (yttria, Y_2O_3) is a white solid that has some uses in ceramics. Discovered by Gadolin in 1794, the element was obtained in purer form in 1843 by Mosander. See also THORIUM.

YUAN SHIH-K'AI, *yoo ahn′ shir′ ki′* (1859-1916), President of the Chinese Republic from 1912 to 1916, was an able general and administrator who held important offices under the Manchu rulers. When the republic was proclaimed, Sun Yat-sen, the leader of the revolution, resigned as provisional president and persuaded Yüan to take the office. Yüan was ambitious and had

THE MEXICAN STATE OF YUCATAN is located at the northern end of the peninsula of Yucatán.



little belief in democracy. He set up a kind of dictatorship and tried to found a new dynasty by making himself emperor. He had to put down many revolts led by the people who did not want a monarchy, and he gave up the idea shortly before his death. See also China, *History*.

YUCATAN′, a peninsula on the southeastern edge of Mexico, includes the Mexican states of Yucatán and Campeche, the territory of Quintana Roo, the northern part of Guatemala, and British Honduras. It stretches northward toward the western tip of Cuba, separating the Gulf of Mexico from the Caribbean Sea. Between Cuba and the peninsula is the Yucatán Channel. (See map on preceding page.)

Yucatán is commercially important as the source of about half the world's supply of henequen and sisal, fibers used in the making of rope and twine. The agave plants from which these fibers are obtained are grown on plantations in the northern districts. In the southern and eastern sections chicle, mahogany, coffee, tobacco, and fruits are the chief products.

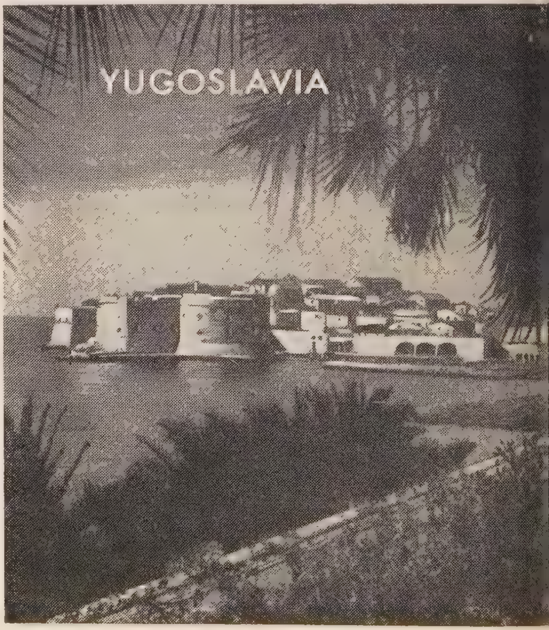
Historically Yucatán is famous as the place where the Mayan Indians built a great civilization centuries ago. The ruins of their extraordinary temple-cities, Chichén Itzá, Uxmal, and Labna, show that these people reached a high level of culture five hundred to one thousand years before the arrival of Europeans in the New World. See Maya.

The northern part of the Yucatán peninsula is low and dry. Farther south, rainfall is heavier, and tropical forests cover the hills. Until the development of air services Yucatán was hard to reach from the west except by sea, because of the dense tropical jungles that form a barrier to travel. Exports and imports generally go through Progreso, the port for Mérida, which is the only large, modern city of the region.

The state of Yucatán, of which Mérida is the capital, covers an area of 23,926 square miles and has a population of about half a million. More than half of the people are descendants of the Maya Indians and speak a Mayan language. Many of them work on the plantations and also cultivate small patches of cleared land for their own use. Mérida, the center of commerce and industry, has about 100,000 inhabitants. See also Agave; British Honduras; Guatemala; Mexico; Sisal.

YUCCA, *yuk′uh*, a genus of shrubs and trees of the lily family, native to the Americas, particularly to the desert areas of the southwestern United States and of Mexico. Yuccas have narrow, swordlike leaves and flower heads of cup-shaped blossoms, usually white or pale yellow. Their fruits may be fleshy berries or dry capsules. The largest yucca is the *Joshua tree*, which may be thirty to forty feet in height. Its contorted branches, armed with tufts of daggerlike leaves, make it the most grotesque of the yuccas. Another type, the *tree* yucca, has a short trunk crowned by a clump of swordlike leaves. A huge flower head three or more feet high rises from the center of the leaf cluster. A third form of yucca is the *desert candle*, which has a base of swordlike leaves centered by a tall, tapering stem crowned by a large cluster of flowers. The buds, flowers, fruits, and the bulbous roots of some species were eaten by the Indians, who also used the fibers of the leaves to make articles of rope and cloth.

Yuccas can be pollinated only by yucca moths, which have specially adapted mouth parts. The female moth lays the eggs in the ovary of a flower, and then pollinates the flower by thrusting a wad of pollen into its hollow pistil. By pollinating the plant, the moth brings about the development of the seeds on which its larvae subsist. The larvae eat only about half of the seeds before they bore through the ovary to drop to the ground, on or in which they pupate. See also Joshua Tree.



YUGOSLAVIA, or **JUGOSLAVIA**, *yoo-goh slah′ vih uh*, is the largest and northernmost of the Balkan countries in southeastern Europe. It is about the size of the American state of Oregon, and it reaches about as far north as Oregon and somewhat farther south. Both have rugged mountains, and both have great rivers in the north — the Columbia in Oregon and the Danube in Yugoslavia. But while Oregon has a population of little more than 1,500,000, Yugoslavia has more than ten times that many people. Most of them are farmers or herders, divided into different racial stocks which have their own "homelands" within the nation.

The country of the Yugoslavs has a great variety of physical features, ranging from towering mountains to broad, rolling plains, and a great range of climate, with bitter cold in some areas, oppressive heat in others, regions of heavy rainfall and regions with very little moisture. In the ancient days of migration between east and west, many peoples passed through the territory which is now Yugoslavia, and Asia, as well as western Europe, has influenced the Yugoslavs and their way of life. Today, as transportation, manufacturing, and industry are being developed, the country is changing in many ways; and because of its geographical and political position in a troubled world, Yugoslavia holds special interest for everyone.

Yugoslavia is a Communist state of six federated republics. It was originally created at the close of World War I as a homeland for the South (Yug) Slavs of Serbia and Montenegro and for those occupying parts of the defeated and divided Austro-Hungarian Empire. During the first ten years of its existence the new nation was known as the Kingdom of the Serbs, Croats, and Slovenes. In 1929, in the interest of national unity, the name of the country was changed to Yugoslavia (land of the South Slavs). Yugoslavia was overrun by German forces in World War II. After its liberation from Nazi control it was reorganized as the Federal People's Republic of Yugoslavia. In 1947, in accordance with a peace treaty with Italy, its boundaries were enlarged by the addition of the major part of the Italian province of Venezia Giulia and the commune of Zadar (Zara), together with nearby islands.

Yugopress

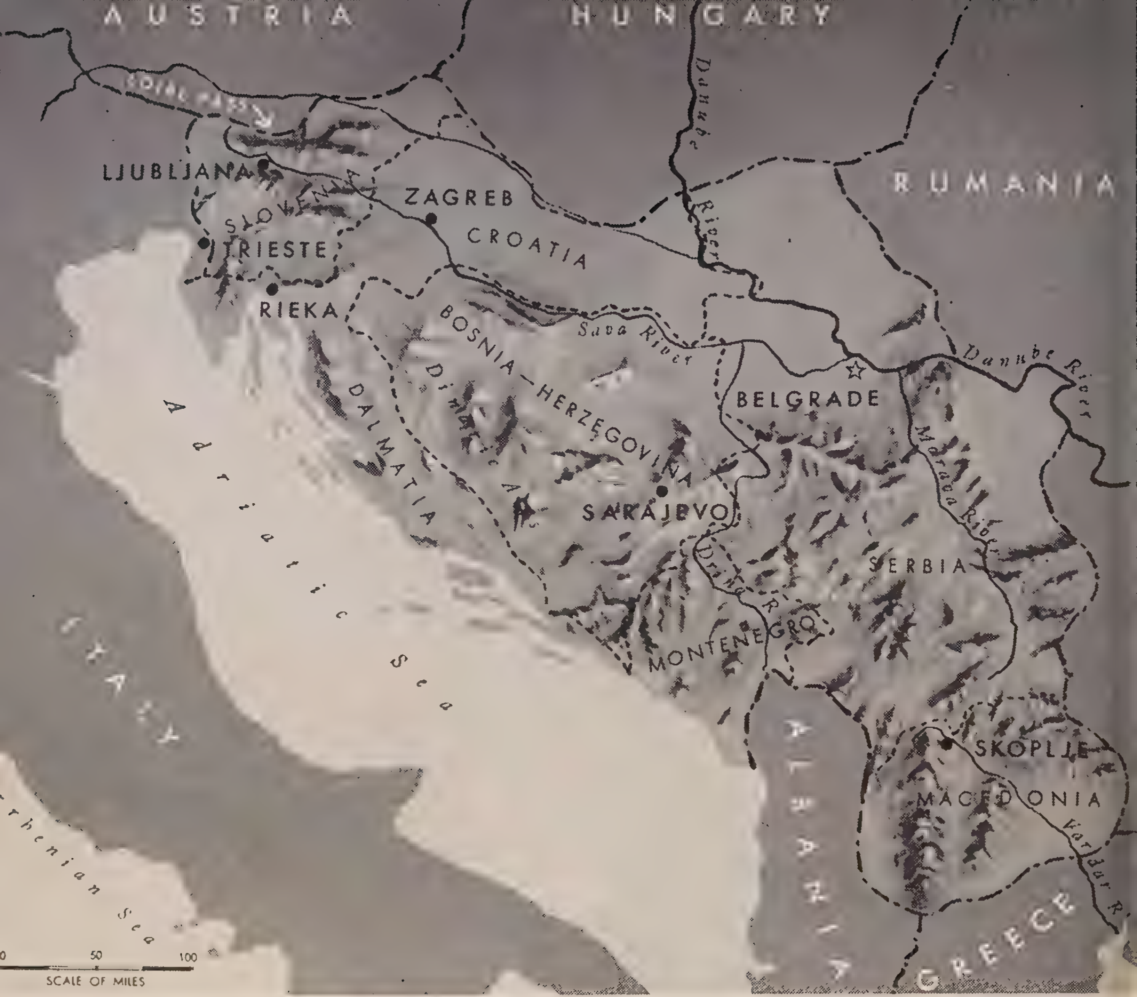
CONTRASTS IN CLIMATE IN YUGOSLAVIA are represented by balmy Dubrovnik on the Adriatic (left), framed in palm trees, and a snowy Alpine scene (right), with ski troops on patrol.

The six federated republics of Yugoslavia are Slovenia, in the northwest; Croatia, to the south and east of Slovenia; Bosnia-Herzegovina, in a central position; small Montenegro, on the southern coast; large Serbia, in the east; and Macedonia, in the southeast. The areas ceded by Italy in 1947 were included in the republics of Slovenia and Croatia. Since then, Yugoslavia also has had a share in the administration of the Free Territory of Trieste, at the north end of the Adriatic Sea.

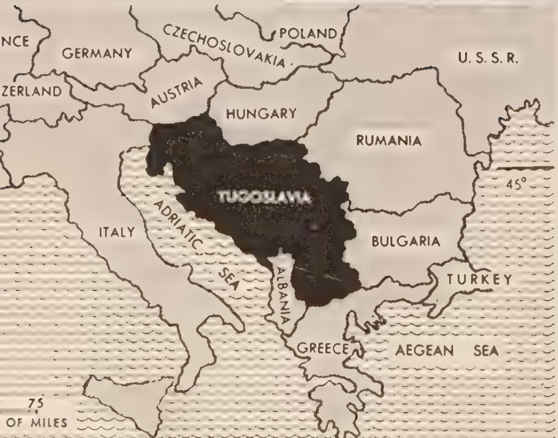
Location and Surface Features. Yugoslavia covers an area of about 99,000 square miles along the eastern shore of the Adriatic. It borders on seven other countries. To the north lie Austria and Hungary; to the east, Rumania and Bulgaria; to the south, Greece; to the south and west, Albania; to the northwest, Italy. The narrow Adriatic coastal area, known as Dalmatia, is now a political region (oblast) of the republic of Croatia.

Like the other states of the Balkan Peninsula, Yugoslavia is largely mountainous. The ranges in the west and northwest are a continuation of the great Alpine system of Central Europe. Along the western coast from the Istrian Peninsula to Albania, the Dinaric Alps form a towering backdrop for the mainland of Dalmatia. On this coast rugged spurs of the mountains have formed numerous fiordlike bays with many excellent harbors. Offshore, hundreds of long islands, the tops of submerged limestone mountains, dot the Adriatic. The spectacular scenery of the Dalmatian coast area has made it a favorite European vacation land. The Dinaric Alps comprise a great belt of limestone ranges and plateaus covering one third of Yugoslavia. The Karst, a dry, barren plateau extending many miles inland, is a striking feature of this mountain system. It is marked by fissures, sinkholes, depressions, caves, and underground streams, caused by the dissolving action of ground water on limestone.

On the Yugoslav-Italian border are the snow-capped Julian Alps, in which Mount Triglav (9,394 ft.) attains the highest altitude in Yugoslavia. In this range, too, is the beautiful lake resort of Bled, summer capital of the government. The Karawan-



SHOWN IN RELIEF IS YUGOSLAVIA, with its six federated republics, its major cities, and its rivers and mountain ranges.



YUGOSLAVIA'S NEIGHBORS include both Communist states, tied to the Soviet Union, and freedom-loving allies of the democratic West.

ken Alps, on the Austrian border, and the North Albanian Alps, on the boundary between Montenegro and Albania, are other extensions of the Alpine system. The Loibl Gap at the Austrian-Yugoslav border has great military significance, for it provides an entrance through which invaders from the north could move against both Yugoslavia and Italy. Yugoslavia's largest lakes are on the Yugoslav-Albanian border. The mountain regions are heavily wooded, and the country is one of the leading timber producers of Europe.

Most of the rivers of Yugoslavia flow into the Danube, which crosses the northeastern part of the country for some 370 miles. This great shipping route has its outlet in the Black Sea. The Adriatic Sea receives the westward-flowing streams, and the Aegean Sea those flowing south through Greece. The only important river flowing into the Adriatic is the 140-mile-long Neretva, a swift mountain stream that becomes navigable for small vessels over part of its course. The Danube and two tributaries, the Drava and the Sava, drain the Pannonian Basin, in the north. This region of fertile plains was in olden times a part of the Roman province of Pannonia. It is the most thickly populated area in Yugoslavia. Not only is the soil productive but the region provides excellent travel routes to other countries served by the navigable Danube system. The flattest part of Yugoslavia is in the autonomous province of Voivodina, to the north of Serbia proper. It is a continuation of the Hungarian plain. The province is crossed from north to south by the Tisza River, which enters the Danube near the capital city of Belgrade (Serbian *Beograd).*

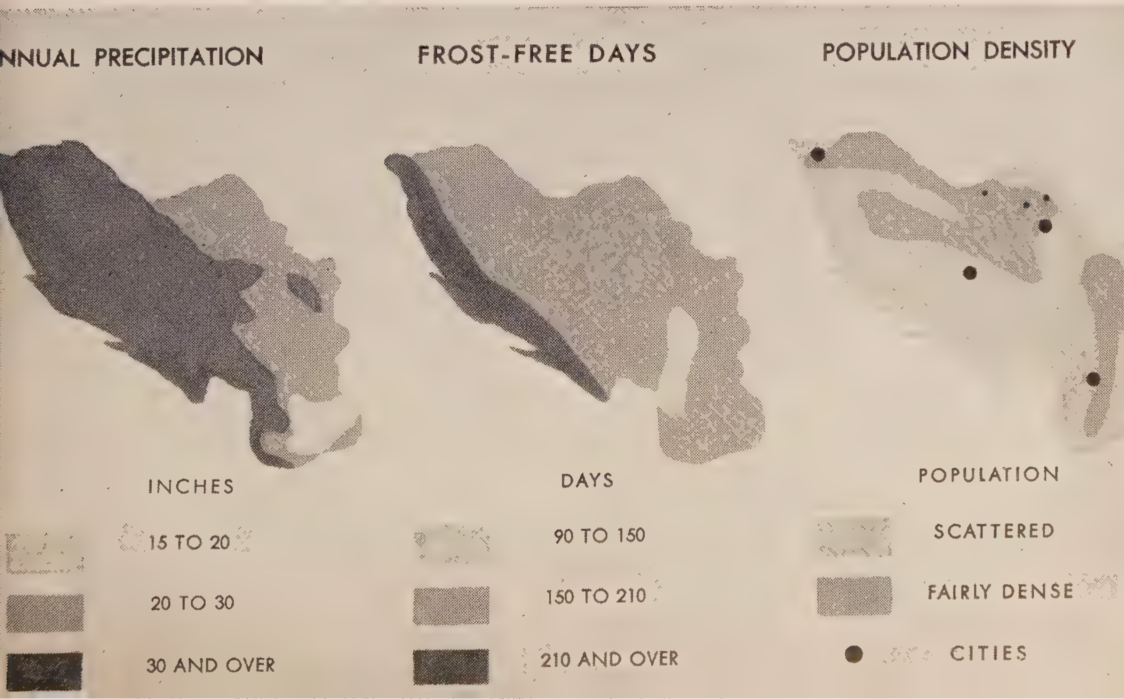
In the east, the plain of central Serbia and Macedonia includes the valleys formed by the Morava and Vardar rivers and by the Ibar, tributary of the Western Morava. The Morava flows northward to the Danube, the Vardar south through Greece to the Aegean Sea, an arm of the Mediterranean. For centuries the Morava-Vardar valley system has served as a north-south highway for travel between Central Europe and the sea. The eastern part of the hilly plateau of Bosnia-Herzegovina is drained by the Vrbas, Drina, and other tributaries of the Sava, all belonging to the Danubian system. Of little value for navigation, Yugoslavia's many mountain streams are a possible source of almost unlimited hydroelectric power.

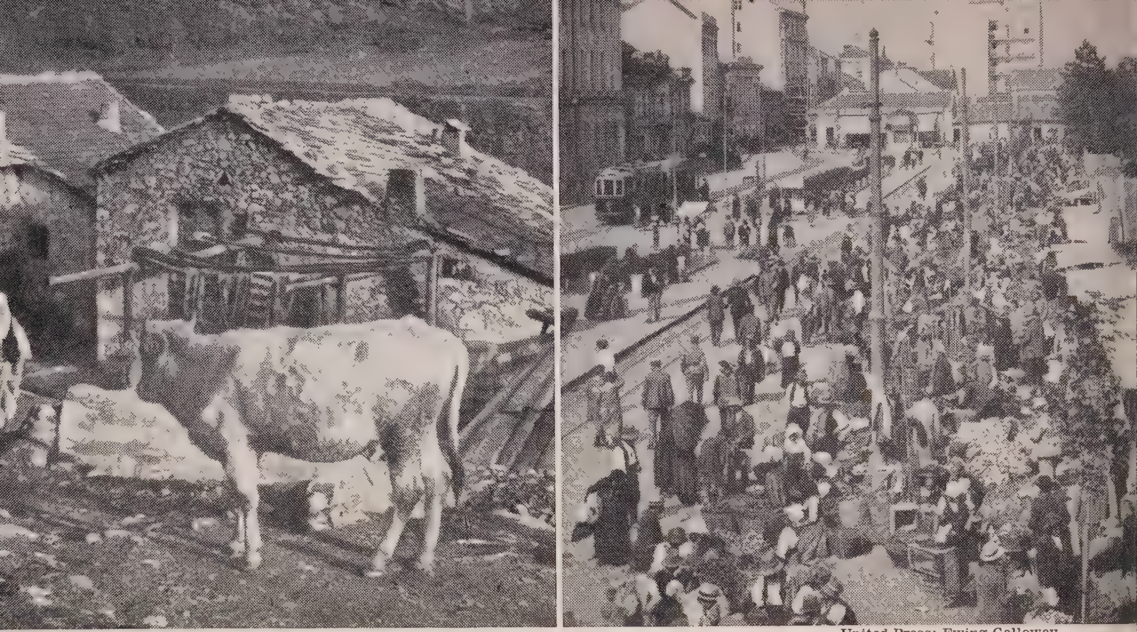
Climate. Because of its location and its rugged surface, Yugoslavia has variations of both Mediterranean and continental climates. The Mediterranean type is found along the southern coast and in the Vardar Valley in Macedonia, where hot, dry summers and mild, wet winters are the rule. Along the northern coast, however, there are occasional cold spells, when the fierce wind called the *bora* sweeps downward from the Alps. The climate of other parts of Yugoslavia is like that of the rest of inland Europe, with great extremes of summer and winter temperatures in some sections. The hottest as well as the coldest weather is experienced in the sheltered Danube Valley. Most of the rain in this section falls during the summer and autumn. The western uplands have considerable rainfall throughout the year, as a result of the meeting of the cold, dry air over the Alps with the warm, moist air from the Adriatic. The wettest spot in Europe is in the Dalmatian coastal mountains, where an annual precipitation of 183 inches has been recorded. The average rainfall for the rest of the country varies from twenty-five to sixty inches a year. The driest area is northern Voivodina, where there are grasslands much like the semiarid steppes of Russia.

The People and Their Activities

The People. Yugoslavia has a population of about 16,000,000. Population figures for the six republics are: Serbia (including the autonomous province of Voivodina and the autonomous region of Rosovo-Metohija), 6,500,000; Croatia, 3,750,000; Bosnia-Herzegovina, 2,560,000; Slovenia, 1,400,000; Macedonia, 1,150,000; Montenegro, 376,000. The Serbs, Croats, and Slovenes form the bulk of a Yugoslav population that includes many racial mixtures and minority nationalities.

THE PEOPLE OF YUGOSLAVIA LIVE IN THE PLAINS and river valleys (see relief features on the large map), where the land can be cultivated and where the rainfall is adequate and the growing season long enough for the raising of crops.





United Press; Ewing Galloway

ON ROUGH, ROCKY HILLSIDE FARMS, many Yugoslavs live and labor as their ancestors did (left). The modern world has had more influence on such cities as Belgrade, where tall buildings and broad, paved streets border the traditional public market (right).

The Serbs, who are the largest single group, are found chiefly in Serbia, Bosnia-Herzegovina, and Montenegro. There are also many Serbs in Croatia, where Croats are the majority group. The Slovenes settled in Slovenia long ago and are still dominant there. Among the minority nationalities are Hungarians, Albanians, Czechoslovaks, Rumanians, Bulgarians, Turks, Italians, and Germans. Many Italians and Germans returned to their own countries after World War II.

Four languages are recognized as official in Yugoslavia — Serbian, Croatian, Slovenian, and Macedonian. Each has its own dialects, but any of these languages can be understood by most of the Yugoslav people. The Serbian and Croatian tongues are so nearly identical in pronunciation that they are usually considered one language, Serbo-Croat. Yet they are written differently. Centuries ago the Croats, together with the Slovenes, occupied territory that had been a part of the Western Roman Empire. They adopted the Latin alphabet for their written languages, and in religion they became Roman Catholics. The Serbs, who came under the influence of the Eastern Roman Empire, use a form of the Cyrillic alphabet, said to have been introduced by St. Cyril, a Greek missionary, in the ninth century. It is but slightly different from the alphabet now used by the Russians.

The Serbs, together with the Macedonians and Montenegrins, show the Eastern influence in their religion as well as in their written language. Most of them are members of the Serbian branch of the Eastern Orthodox Church. Bosnia and Herzegovina became strongholds of the Moslem, or Mohammedan, faith after they came under Turkish control in the fifteenth century. The influence of Turkish occupation is still evident in their mosques and minarets. The Orthodox faith, too, is strong in Bosnia-Herzegovina, and there are large numbers of Mohammedans in southern Serbia and Macedonia.

Farming. After the Communists came to power in Yugoslavia in 1945, they sought to modernize the country's agriculture, which provides a livelihood for about 70 per cent of the working people. They pushed the reforms, begun in the 1920's, to break up the large estates held by wealthy landowners and church groups and to do away with the ancient system that forced the peasants to share their crops with the owners. Once the peasants had acquired their own farms, however, the Communist authorities urged them to pool their holdings in co-operatives like the collective farms of the Soviet Union. But so great is the peasants' love of independence that only a minority co-operated in the new plan. It received strongest support in Voivodina. In 1953 the government decided to abandon collective farming.

The more prosperous farms are found in the fertile regions of the northwest and the southeast. Leading field crops include corn, wheat, oats, rye, barley, hops, potatoes, sugar beets, rice, flax, and hemp. Grapes, peaches, apples, and other fruits are raised in these regions, and tobacco is produced in the lower Vardar Valley. The southern Dalmatian coast yields such semitropical crops as cotton, figs, olives, and citrus fruits. The sandy delta of the Neretva River, which has been made fertile by irrigation, is very productive. Vineyards on the Dalmatian coast, some on mountain terraces, produce a fine grade of wine. Around Belgrade and other large cities, truck gardening is important. The amount of land suitable for farming has been increased by drainage in the marshlands of Croatia and by irrigation in various semiarid sections.

Yugoslavia has long been one of the more important stock-raising countries of southern Europe. Large herds of sheep graze on the central plateau in summer and in the coastal and river-valley meadows in winter. Cattle, horses, donkeys, and mules are raised in the grain-producing northern plains. The cornlands of Croatia and Voivodina and the acorn-rich forests of Bosnia-Herzegovina are centers of hog raising, and goats graze on the scanty vegetation of the Karst plateau and the southern highlands. Beekeeping and poultry raising are widely practiced.

Mining. Yugoslavia is the chief mineral producer of the Balkan Peninsula. It leads all Europe in the mining of antimony, lead, and bauxite (the ore of aluminum) and ranks high in the production of copper, zinc, and mercury. New deposits of coal and iron ore and of good steel-alloy metals — manganese, tungsten, chromite, and molybdenum — are supplying the growing steel industry. Serbia, Montenegro, and Macedonia are the chief sources of these minerals. The petroleum industry is being developed in Slovenia and the salt industry in Bosnia-Herzegovina. The Karst plateau is one of the richest sources of bauxite in Europe.

Manufacturing. The chief aim of Yugoslavia's first Five Year Plan, launched by the Communist government in 1947, was to change Yugoslavia from a backward state into a modern, industrialized one. In the process the government took over ownership or supervision of all economic enterprises. As a result of the nationalization program (now controlled by the individual federated republics), the raw materials of farm and mine are now used far more than in earlier times by the country's own industries. A shortage of skilled laborers and of competent engineers, a lack of technical experts, and inexperience in the art of economic planning were drawbacks to the rapid completion of the Five Year Plan.

Yugoslavia's industrial progress is based largely on a program of electrification, with swift mountain streams harnessed to supply hydroelectric power. This power is used to operate textile mills in Belgrade and Zagreb (Croatia); aluminum-reduction works in Sibenik (Croatia); and heavy-industry factories in Zenica (Bosnia), Ljubljana (Slovenia), Rieka (Croatia), and Subotica (Voivodina). An expansion of the lumber and cement industries made possible a building boom in New Belgrade and other cities.

Food processing, including flour milling, sugar refining, fruit canning, olive-oil pressing, and meat packing, has long been a major industry in Yugoslavia. The production of wines, beers, and liqueurs is important, and the old crafts of weaving carpets and making jewelry and copperware are still followed in some areas.

Transportation. As long ago as the days of the Roman conquests and Slavic migrations, the river valleys and mountain passes which are now included in Yugoslavia provided routes for peoples moving southward into the lower Balkan Peninsula or northward to the Carpathian Mountains and the Tirolean Alps. The outstanding transport center today is Belgrade. Located at the junction of the Danube and Sava rivers, this city is the hub for river, rail, highway, and air traffic. Since medieval times, Zagreb and Ljubljana to the west have been important stops on the road leading to the Austrian capital of Vienna. Today Yugoslavia has about 1,600 miles of navigable canals and rivers, 30,000 miles of roads, and 7,500 miles of state-owned railroad. A 240-mile superhighway, Yugoslavia's first motorized road of its kind, connects Belgrade and Zagreb. Rieka (formerly Italian Fiume) and Split, both on the Adriatic Sea, are the leading ports.

Government and Education

Government. Although Yugoslavia has a constitutional parliamentary form of government, the head of the state governs with few restraints and is in effect a dictator. The first constitution under the Federal People's Republic was adopted in 1946. It provided for a National Assembly, or parliament, of two houses — a Federal Council and a Council of Nationalities. The highest official, the Prime Minister, was head of a Cabinet of three vice-premiers, two commission chairmen, and twenty-one ministers. In January, 1953, a revision of this constitution went into effect. The office of Prime Minister was replaced by that of President. The National Assembly was reorganized. It is now made up of a Federal Council elected by popular secret vote and a Council of Producers representing economic groups. The Cabinet was replaced by a Federal Executive Council.

Each of the six federated republics is governed by its own assembly and executive officers. The autonomous province of Voivodina and the autonomous region of Kosovo-Metohija are attached to Serbia for administrative purposes.

Education. The schools of Yugoslavia are either state-owned or, in the case of private church schools, state-controlled. Eight years of education in the elementary schools of the federated republics is free and compulsory. By means of government grants and scholarships, capable students are offered higher education in secondary schools, technical schools, and teachers' training colleges. Universities are located in Belgrade, Zagreb, Ljubljana, Sarajevo, and Skoplje.

History

When the South Slavs gained their independence at the close of World War I, the Serbian king, Peter I, was chosen as ruler of the Kingdom of the Serbs, Croats, and Slovenes. Serbia's attempt to control the new nation was resented by the Croats, and after Alexander I ascended the throne in 1921, they sought to change the system of centralized government, which concentrated all administrative power in the Serbian city of Belgrade. Led by Stefan Radić of the Croatian Peasant party, they threatened to secede. As a result, the King dismissed the parliament and established a royal dictatorship in 1929. Although Alexander made certain constitutional reforms and sought to strengthen national patriotism by changing the kingdom's name to Yugoslavia, the Croats remained dissatisfied, and in 1934 the King was assassinated by a Croat-Macedonian terrorist.

The regency set up during the minority of Peter II continued to work for Serbian control, and it was not until 1939 that Croatia gained a measure of self-rule. Earlier, Yugoslavia had allied itself with France and, as a member of the Little Entente, with Czechoslovakia and Rumania, but by the late 1930's Germany's economic power forced the Yugoslav Government to favor the Nazi state. When the regency council signed the Tripartite Pact, allying Yugoslavia with Germany, Italy, and Japan, in March, 1941, revolts broke out. The Nazi invasion which followed in April brought about a 10 per cent loss in population and one of the heaviest property losses suffered by any invaded land. The Axis powers set up puppet governments in Serbia and Croatia and divided the rest of Yugoslavia into German, Italian, Hungarian, and Bulgarian zones.

Two irregular armies soon sprang up to liberate Yugoslavia. One group, called the Chetniks, was led by Draža Mihajlović, war minister of the royal government in exile. The other group consisted of Communist fighters called Partisans, led by Josip Broz, or "Tito." The two armies used guerrilla tactics in harassing the occupation forces from their mountain hide-outs; but because Mihajlović was accused of collaborating with the Germans, the Allied powers supported the Partisans during the closing months of the war in 1944-45.

The Communists won their final victory in the plebiscite of November, 1945, in which the people voted to abolish the monarchy. A few weeks later the Federal People's Republic of Yugoslavia was established, with Tito as Prime Minister. Yugoslavia joined the United Nations and became a member of the bloc of Soviet satellites belonging to the Cominform (Communist Information Bureau). Three years later the country was put out of the Cominform, because Tito refused to allow Yugoslavia's natural resources to be exploited for the benefit of Soviet industry. Back of this refusal was a determination that Yugoslavia should not again be reduced to the lowly position which had been its lot when it was under the domination of the powers of western Europe. The United States and other democracies came to look on Yugoslavia as a powerful, if peculiar, barrier to Soviet expansion westward, and American aid was granted to this Communist state. In January, 1953, Tito was elected President by the parliament then in session.

Related Articles. For further information, consult the following titles:

Adriatic Sea
Aegean Sea
Austria-Hungary
Balkan Peninsula
Balkan Wars
Belgrade
Bosnia
Croatia and Slavonia
Dalmatia
Danube River
Fiume (Rieka)
Macedonia
Montenegro
Russia
Serbia
Slavs
Tito
Trieste, Free Territory of
World War (I, II)

Quick Facts About Yugoslavia

Area: 99,082 sq. mi. (Slovenia, 7,796 sq. mi.; Croatia, 21,611 sq. mi.; Bosnia-Herzegovina, 19,909 sq. mi.; Montenegro, 5,343 sq. mi.; Serbia, 34,194 sq. mi.; Macedonia, 10,229 sq. mi.).

Population: 16,000,000; population density, about 164 per sq. mi.

Chief Cities: Belgrade (capital, 389,000); Zagreb (290,600); Ljubljana (121,000); Sarajevo (118,800); Skoplje (91,500); Novi Sad (77,700); Rieka (73,000).

Farm Products: Grains, hops, potatoes, sugar beets, rice, flax, hemp, fruits, tobacco, cotton, honey, livestock, poultry.

Manufacture: Production of textiles, metal products, building materials, paper, processed foods, tobacco products; electric-power production; processing of ores, oil, and coal.

Exports: Timber, copper, medicinal plants, tobacco, fruits, wines, bauxite, cement, lead.

Imports: Textiles, metal and metal manufactures, machinery, fuel, lubricants, electrical appliances, chemicals.

Government: Federal republic made up of six federated republics, each governed by its own assembly and executive officers. Chief executive head of the nation, the President, is assisted by a Federal Executive Council. Chief legislative body of the republic is the two-house National Assembly.

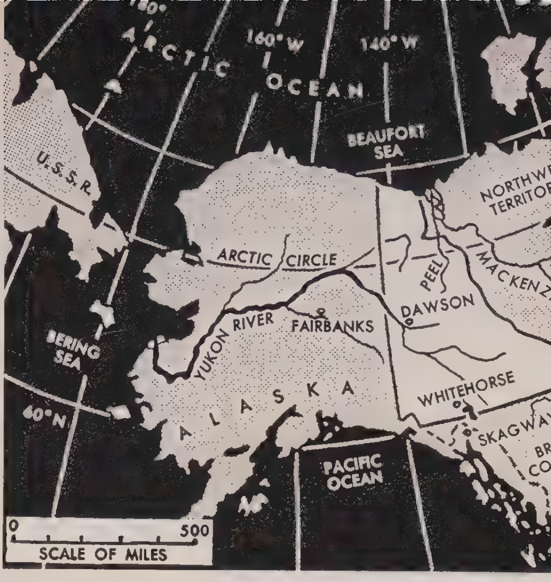
Religion: Eastern Orthodox (47 per cent); Roman Catholic (36 per cent); Mohammedan (11 per cent); others (6 per cent).

Flag: Blue, white, and red horizontal bars, with a red five-pointed star in the middle.

Monetary Unit: Dinar.

YU'KON RIVER, one of the longest rivers in North America, is formed by the joining of the Lewes and Pelly rivers in Yukon Territory, northwest Canada. From the source of the Lewes, in northern British Columbia, to the mouth of the Yukon is a distance of more than two thousand miles. The Yukon flows to the northwest past Dawson and into Alaska, where it makes a wide bend to the south and west, emptying into Bering Sea just south of Norton Sound. Its principal tributaries are the Stewart, the Klondike, the Porcupine, the Koyukuk, and the Tanana. The Yukon is navigable in the summer, from June to October, and river boats travel as far as Whitehorse, on the Lewes.

YUKON TERRITORY, a region in the northwestern corner of Canada, is bounded on the west and the southwest by Alaska, on the east by the Northwest Territories, on the south by British Columbia, and on the north by the Beaufort Sea and the Arctic Ocean. It has a total area of 207,076 square miles, of which more than 1,700 square miles are water. The Yukon is an elevated plateau crossed by high mountain ranges and cut by many streams and rivers. The Rockies, the Mackenzie Mountains to the east, and the St. Elias range, including Mount Logan (19,850 ft.) in the southwest corner of the Territory, make the region a rugged wilderness. Yukon winters are long and cold, the summers brief and hot. Rainfall is not heavy, but it is enough for the crops of hardy vegetables and grains that are grown in the river valleys. During the warm months insect pests make life miserable for human beings and for domestic animals. The few people who inhabit the Yukon are sturdy white pioneers and Indian trappers and hunters. There are about 7,500 whites and 1,500 Indians. Most of the whites are engaged in mining.



FROM CANADA'S YUKON TERRITORY, shown in white, the mighty Yukon River cuts across Alaska on its way to Bering Sea.

The chief rivers are the Peel, which empties into the Mackenzie River at the delta, and the Yukon, with its many tributaries. The Yukon River is one of the main channels of traffic. It is navigable for river boats as far as Whitehorse (population about 2,600), largest town in the Territory. Whitehorse is also the terminus of the only railroad, which runs south and west to Skagway, in Alaska. The principal motor road, the Alaska Highway, runs through Whitehorse. Air travel is the commonest form of transportation between Whitehorse, the seat of government, and Dawson, headquarters of the mining industry. There is regular air service between these towns and the cities of Alaska and British Columbia.

Dawson, on the Yukon River near its junction with the Klondike, has a population of about 800. In the boom days of the Klondike gold rush, near the turn of the century, it had more than 20,000 inhabitants. Gold is still mined in the region of Dawson, and the output of minerals is valued at more than $5,000,000 a year. In gold-rush days individual prospectors panned the river beds for gold. Most of the present mining operations are handled by machinery.

Yukon Territory is governed by a commissioner, who is appointed, and a territorial council of three members who are elected for three-year terms. The Yukon sends one representative to the Canadian Parliament. See also CANADA; DAWSON; KLONDIKE; YUKON RIVER.

YWCA. See YOUNG WOMEN'S CHRISTIAN ASSOCIATION.

Z, the twenty-sixth and last letter of the English alphabet, is a form of the Greek letter *zeta*. It is usually called *zee* in American English and *zed* in British English and in some continental languages. In most of the English words in which it is used, *z* has the sound of *s* as in *rose*. Examples are *prize, zeal, jazz*. It is pronounced like *zh* in words such as *azure, seizure*. See also Alphabet.

ZAHAR'IAS, "Babe" [Mildred] Didrikson (1913-1956), the greatest woman athlete of all time and, in the opinion of many sports experts, the most versatile athlete of either sex ever known. Born in Port Arthur, Tex., she became an outstanding woman basketball player while still in her teens. She developed amazing proficiency in such varied activities as baseball, swimming, billiards, figure skating, rifle shooting, hurdling, running, jumping, and javelin throwing. In the 1932 Olympics she broke two track-and-field world records for women. Only golf came hard. But she liked it best, practiced it in earnest, and became the greatest of women golfers. She won every major title, triumphed in scores of amateur and professional tournaments, and set many women's records. She was married to George Zaharias in 1938.

ZAMBE'ZI RIVER, in southern Africa, rises in the northwestern corner of Northern Rhodesia and flows southwest and then south, across eastern Angola and the western part of Northern Rhodesia. It marks the boundary between Northern and Southern Rhodesia and then turns generally east and southeast through Mozambique, to empty by way of a large delta into the Mozambique Channel and the Indian Ocean, about 1,650 miles from its source. The river and its many tributaries drain an area of half a million square miles. One of the chief tributaries is the Shire, which flows south out of Lake Nyasa and joins the Zambezi above the delta (see Nyasa, Lake).

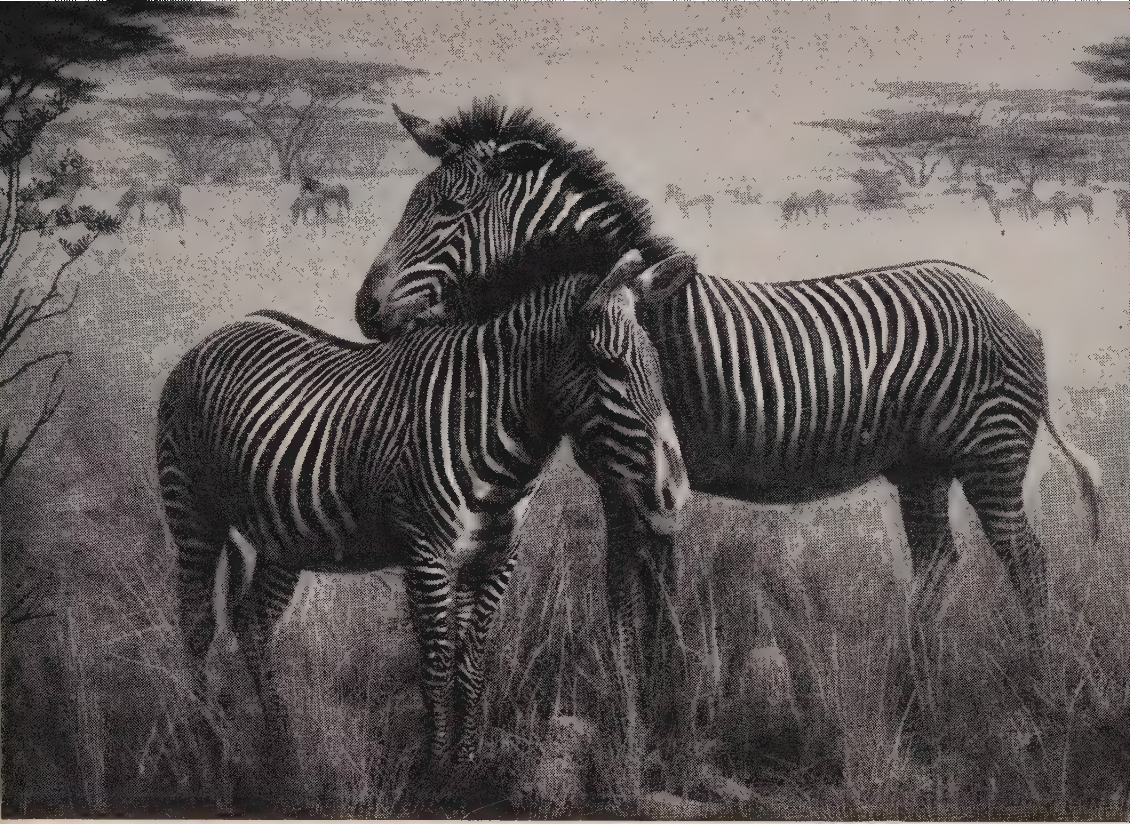
On the border between Northern and Southern Rhodesia, where the Zambezi is about a mile wide, it suddenly plunges into a deep slot in the earth. This fissure is 350 feet deep and about 400 feet across. These spectacular falls of the Zambezi were named the Victoria Falls by Livingstone, who was the first to explore this section of the river (see Victoria Falls). Below the falls the river passes through a deep, narrow canyon. In its lower course the Zambezi is navigable from the sea to the Quebrabasa Rapids, about 400 miles upstream, and river boats are used on several sections of the upper river. See also Africa (and map).

ZANG'WILL, Israel (1864-1926), a British writer, was born in London of Jewish parentage and received his education at the Jews' Free School and the University of London. He achieved great success in 1892 with the first of his realistic novels of Jewish life, *The Children of the Ghetto*. Among his other works, which included essays, dramas, novels, and humorous sketches, were *Ghetto Tragedies, Dreamers of the Ghetto, The Master, The Mantle of Elijah, Merely Mary Ann, The Melting Pot*, and *We Moderns*. Besides serving as an effective interpreter of Jewish life and character, Zangwill was an early leader of the Zionist Movement (see Zionism). He lectured to large audiences on both sides of the Atlantic.

ZAN'ZIBAR, a British protectorate off the east coast of Africa, about 6° south of the equator, is made up of two tropical islands, Zanzibar and Pemba. Zanzibar Island, which has an area of 640 square miles, is about twenty-two miles from the mainland, and Pemba (380 square miles) lies about twenty-five miles to the northeast of Zanzibar. The land is generally fertile, and rainfall is ample. Zanzibar specializes in raising clove trees and produces about 80 per cent of the world's supply of cloves. Coconut palms and citrus fruits are also grown. Copra is one of the principal exports.

Zanzibar is also the name of the chief city and capital of the protectorate. The town, on the west coast of Zanzibar Island, has a good harbor and has been for centuries an important station on the trade routes between India, Arabia, and Africa. It was a center of slave trade until the end of the nineteenth century, when the British put an end to traffic in slaves.

The ruling sultan and many of the landowners of Zanzibar are Arab; the early sultans came from Muscat (Masqat), in southeastern Arabia. But the 45,000 Arabs repre-



California Academy of Sciences

LARGEST OF ZEBRAS, Grevy's zebra may reach a height of five feet at the shoulder.

sent less than one sixth of the population. There are about 200,000 Swahili-speaking Africans of various tribes who are mainly laborers and farmers on a small scale. The Indians, who form a small minority of about 15,000, are chiefly in trade and commerce. Most of the people are Moslem. Only a few hundred Europeans live permanently in Zanzibar. Zanzibar is governed by the sultan and by the British Resident, with the aid of an executive and a legislative council. The protectorate is considered a part of British East Africa.

ZEALAND, *zē'land* (Danish *Sjaelland*), the largest and most important of the islands of Denmark, lies east of Jutland, close to the mainland of Sweden. Copenhagen, the Danish capital, is on the northeastern coast. Zealand, which is about eighty miles long from north to south and about sixty-five miles wide, is fine farm and dairy country, with fertile, flat lands. More than three fourths of the land is cultivated. The island is linked to Fünen (Fyn) and Jutland by ferry service, steamship lines, and air service. A long bridge joins it to Falster, on the south. The area of Zealand is about 2,680 square miles. See also COPENHAGEN; DENMARK.

ZEBRA, a striped animal of Africa closely related to the horse and wild ass. Smaller than the typical horse, zebras range from three and one-half to five feet in height. There are three general types, all marked with dark-brown or black stripes on a yellowish, cream-colored, or white background. *Mountain,* or *true,* zebras, which were once abundant in southern Africa, are now becoming extinct except where protected in reserves. They stand about four feet at the shoulders and may be identified by the gridiron pattern of the stripes on the hindquarters. *Hartmann's* zebra belongs to this group. The zebras known as *quaggas* are found in southern and eastern Africa. Their stripes are broader and fewer in number, and some races have lighter-colored "shadow" stripes between the usual dark stripes. The typical form, now extinct, had no stripes on the legs or hindquarters. The fully striped races still surviving include *Boehm's* zebra, *Burchell's* zebra, *Chapman's* zebra, *Grant's* zebra, and *Wahlberg's* zebra. The third group of zebras contains only one species, *Grevy's* zebra. Largest of all zebras, it inhabits eastern Africa in the region of Ethiopia and Somaliland. It is distinguished by its narrow stripes, white hindquarters, and fringed ears.

Zebras travel about the highlands and plains of Africa in small herds, feeding on grasses and grains. When the herd is threatened by a lion or some other enemy, the animals form a circle with heads facing inward and defend themselves by vigorously

By Deane Dickason, from Ewing Galloway

THREE ZEBUS TRAMPLE THE GRAIN in the threshing yard of a farm in India.

kicking backward. Under good living conditions zebras have a life span of about twenty years. Their call is something like a donkey's bray, though not quite so harsh, and their running speed is estimated to be about forty miles an hour. The African natives eat the zebra's flesh and use its hide for clothing and shelter. Animals that have been caught young or raised in captivity can sometimes be trained to draw carts and carriages, but the older animals usually can never be completely tamed.

Scientific Names. Mountain zebra, *Equus zebra;* quagga, *E. quagga;* Grevy's zebra, *E. grevyi.*

ZEBU, *ze' boo,* the name of the common cattle of India. A zebu differs from other cattle in several ways. It has a large hump over its withers. Its forehead is rounded, and its ears are huge and usually drooping. A great dewlap extends the entire length of its neck, and a drape of loose skin hangs under the abdomen of the male. The many kinds of zebus range considerably in size. Some are the size of large dogs and others are as big as buffaloes. Most kinds are ashy gray to creamy white in color, but others are red, tan, and black. In India zebus serve as beasts of burden and as milk cattle. Some white bulls that are declared sacred are allowed to wander at will through the streets, helping themselves to food from sidewalk stands and blocking traffic without hindrance from the pious Hindus. Zebus have been imported into many countries, chiefly because of their ability to endure heat and because of their resistance to ticks and cattle diseases. In the United States, where they are called Brahman cattle, they have been crossbred with several breeds of beef cattle. They are particularly numerous along the Gulf Coast.

Scientific Name. *Bos indicus.*

ZEBULUN, *zeb' yoo lun,* one of the twelve tribes of ancient Israel, was named for the sixth son of Jacob and Leah (Gen. 30:20). The territory it occupied was in northern Palestine, in the area where Jesus later preached. According to some sources the region of Zebulun was landlocked; other sources indicate that it stretched westward to the Mediterranean. In Judges 5:18, Deborah sings the praises of the warriors of Zebulun for their bravery in the struggle between Israel and the Canaanites. See also DEBORAH.

ZECHARIAH, *zek uh ri' uh,* the traditional author of the Book of Zechariah in the Old Testament. He lived late in the sixth century B.C. and urged the rebuilding of the Temple at Jerusalem, the great project undertaken by the Jews upon their return from captivity in Babylon. The Book of Zechariah is one of the Old Testament books known as the Minor Prophets. The first part is an outstanding example of apocalyptic writing, describing visions of the future progress of the Jews and the final coming of the Messiah. The last chapters (9-14) are so different from the rest of the book that most modern authorities believe they were written by another author, probably long after Zechariah had completed his call for an end to wickedness and weakness and a rebirth of morality, devotion, and hope.

ZEDEKIAH, *zed ee ki' uh,* the last king of Judah, was twenty-one years old in 597 B.C., when the Babylonian conqueror, Nebuchadnezzar, made him puppet ruler of the kingdom. He disregarded the advice of the prophet Jeremiah and allowed the patriot party in Judah to persuade him to form an alliance with neighboring states and seek Egyptian aid against Babylonia. Angered, Nebuchadnezzar invaded Judah and laid siege to Jerusalem, which fell in 586 B.C. Zedekiah was forced to witness the slaying of his sons and was then blinded and taken in chains to Babylon, where he died. His story is told in II Kings 24-25, II Chronicles 36, and the Book of Jeremiah 52.

ZEND-AVES'TA, or **AVESTA,** the sacred scripture of the Zoroastrians. It is the "bible" of the Parsees, a Zoroastrian sect still active in India. The present collection of writings represents the surviving remnant of the ancient religious code. The Zend-Avesta as it now exists contains both very old material and much later revisions and supplements, added by the priests who took part in the final reconstruction. Of most importance in the Zend-Avesta are the Gathas, which are preachings of Zoroaster himself, the founder of the sect. These occur in the section known as the Yasna. Supplementing this section is the Vispered. Guides to right action and sacred ritual are included in the Vendidad, which sets forth laws concerning such matters as farming, health, and sanitation. The Yashts are hymns glorifying the angelic host. Less important religious writings, both complete and incomplete, are also included. See also ZOROASTRIANISM.

ZE'NITH, the point in the heavens directly overhead, 90° above the horizon. The opposite point directly underneath, on the invisible half of the heavens below the horizon, is the *nadir.*

ZE'NO. See STOICISM.

ZENOBIA, *zee no' bih uh,* Queen of Palmyra in Asia Minor, was the second wife of Odenathus, who reigned in Palmyra under the authority of Rome. Odenathus was murdered A.D. 267, perhaps with the connivance of Zenobia, and Zenobia's son Vaballathus succeeded his father as king. Zenobia, who acted as regent for her son, was a brilliant, energetic, and ambitious woman. She led armies which conquered a large part of Asia Minor and attacked Egypt. When she had her son proclaimed emperor in 270, the Roman Emperor Aurelian led an expedition against her, defeated her in battle, and took her and her son captive. They were marched in chains in Aurelian's triumphal procession, but instead of being put to death afterward they were pardoned and allowed to settle near Rome.

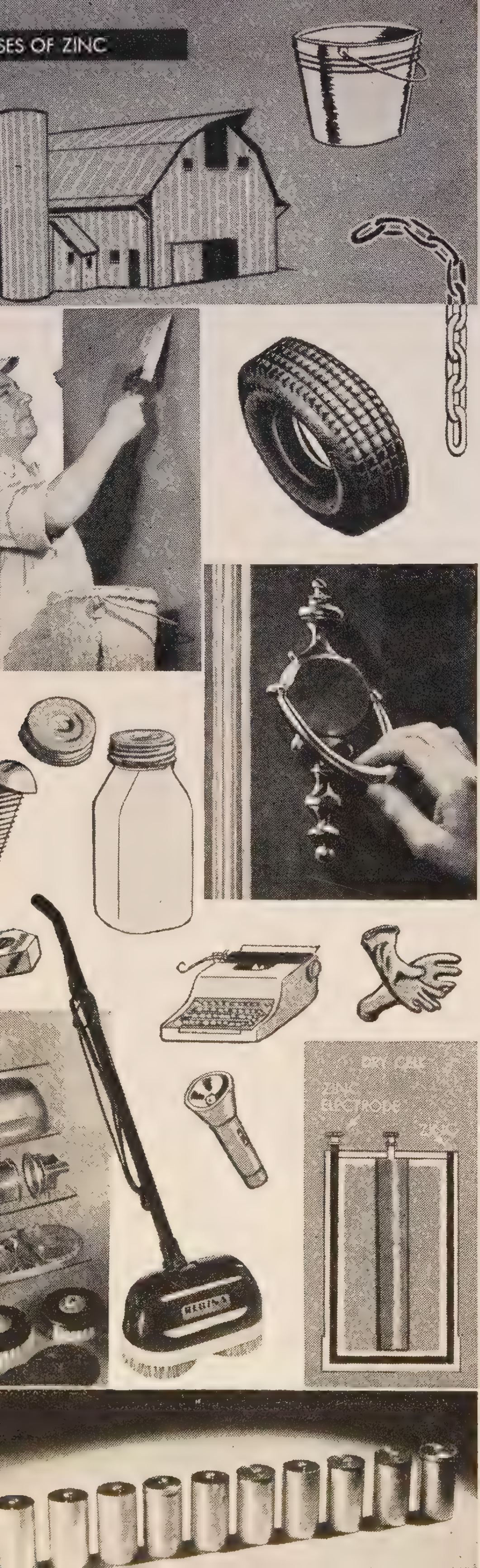
ZEPHANIAH, *zef uh ni' uh,* author of the ninth book of the Twelve Minor Prophets, who prophesied during the reign of Josiah, King of Judah. His book is believed to have been written before 621 B.C., and it may have been inspired by the threat of a Scythian invasion a few years earlier (see SCYTHIANS). Its three chapters threaten destruction for Jerusalem and other nations which have sinned in God's sight; the closing verses, however, promise that a "remnant of Israel" will be saved and blessed.

ZEPPELIN, *zep' eh lin,* FERDINAND VON, COUNT (1838-1917), inventor of the first successful rigid dirigible. Born in Constance, Germany, he was educated at the polytechnical school in Stuttgart, at the military school in Ludwigsburg, and at the University of Tübingen. He entered the army in 1858, and during the American War between the States he served as a German observer with the Union forces. While in the United States he made his first balloon ascent. After his return to Germany he fought in the Seven Weeks' and Franco-Prussian wars. In 1891 he was retired from the army, and the dirigible was thenceforth his chief interest. His first ship, completed in 1900, made a brief flight but was destroyed in landing, and it was not until six or seven years later that he succeeded in producing a practical craft. By 1914 he had constructed twenty-six Zeppelins; yet during this period at least thirteen of the airships were destroyed, with great loss of life. During World War I, Zeppelins made several bombing raids over England and Belgium, but they were too easily destroyed by gunfire to be practicable in war. See also DIRIGIBLE.

ZE'RO, represented by the symbol 0, was first used in mathematics as a *place holder,* that is, as a symbol to denote the *absence* of a number. This usage enables us to distinguish between such numbers as 27, 207, and 270, and corresponds to an unused column of an abacus (see ABACUS). Zero used in this way is an invention usually credited to the Hindus before A.D. 700, but the Babylonians seem to have had a symbol for a place holder as early as 300 or 400 B.C. Our system of writing numbers is a decimal notation invented by the Hindus. With it we can write any number whatever by using only the ten digits 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0. See ARITHMETIC; DECIMALS; ROMAN NUMERALS.

The second use of zero, as a whole number or integer in computations, was first made by the Hindus. Nowadays in arithmetic classes every child learns many addition, subtraction, multiplication, and division facts about zero: for example, that

$5 + 0 = 5$ $5 - 0 = 5$ $5 \times 0 = 0$
$0 + 5 = 5$ $5 - 5 = 0$ $0 \times 5 = 0$
$0 + 0 = 0$ $0 - 0 = 0$ $0 \times 0 = 0$ $0 \div 5 = 0$



SES OF ZINC

He also learns that zero cannot be used as a divisor. In algebra the use of negative numbers makes subtractions from zero possible, such as $0 - 4 = -4$, and $0 - a = -a$ (see ALGEBRA, *Signed Numbers*). A meaning is also found for the zeroth power of a number, namely, that any number with zero for an exponent is equal to 1; that is, $a^0 = 1$, or $10^0 = 1$. See LOGARITHM; POWER.

The number zero marks the initial point of many scales on graphs and on instruments such as voltmeters and speedometers. On outdoor thermometer scales, which show temperatures below as well as above zero, the zero-degree mark (0°) is midway between the marks for +1° and −1°, +10° and −10°, and so on (see THERMOMETER, *Temperature Scales*). On geographical globes and maps the zero of the latitude scale is the equator, and the zero of the longitude scale is usually the meridian through Greenwich. See also ABSOLUTE ZERO; LATITUDE; LONGITUDE; MAP.

ZEUS, *zuse*. See JUPITER.

ZINC is one of the most useful metals. It is relatively easy to separate from its ores, is usually cheaper than lead, and has many properties that find a variety of applications in industry. The free metal does not occur in nature and was not produced in Europe until about 1740, though it seems to have been smelted in India several centuries earlier. About the mid-nineteenth century commercial smelting of zinc began in Europe and in the United States, which is now the largest single producer and consumer of the metal. Zinc is one of the so-called trace elements that occur in minute quantities in many foods and in the body, and are needed for normal growth and development.

Uses. Smelted and refined zinc is sold in slabs *(spelter)* in six grades which are 98 to 99.99 per cent pure. Nearly half the entire output is used for galvanizing iron and steel wire, chain, pipes, tubes, strips, and sheets from which many products are made, from nails, pails, and washboards to roofing (see GALVANIZED IRON). Rustproof coatings are also applied by spraying on molten zinc or by *sherardizing,* a process that gives an abrasive-resistant coat of zinc-iron alloy to small articles such as nuts, bolts, and washers by heating them in zinc dust to a temperature below its melting point (see ALLOY).

Large tonnages of the finest slab grades go into zinc-base alloys made of zinc (90-96%) and one or more such metals as aluminum, copper, and magnesium. These alloys are used in making die castings of parts for vacuum cleaners, typewriters, and other home and office machines; of engine parts, hardware, and radiator grilles for automo-

Ewing Galloway, N.Y.; New Jersey Zinc Company biles; and of lamps, small statues, and other ornaments (see DIES AND DIESINKING); they are sometimes used instead of the more expensive tin-base alloys for bearings (see BEARING). Third in importance is the use of zinc for brass and other copper-base alloys such as bronzes, German silver, and gun metal.

Rolled zinc in plates, thin sheets, strips, rods, wire, and foil, sometimes containing small amounts of lead, iron, cadmium, or copper, is used for photoengravers' plates and lithographers' sheets, weather strips, eyelets and grommets, corrugated roofing, and the cans that enclose dry batteries and form their negative terminals. Much zinc is used for making compounds and as a chemical reagent; the dust or powder goes into paints, lubricants, synthetic rubber, making dyes, desilvering lead, and extracting gold and silver from their ores in the flotation process (see METALLURGY).

Properties. Zinc is harder than lead but must be used where it is not under a continuous load or stress that may deform it. Crystalline in structure and brittle at ordinary temperatures, it is ductile and malleable between 100° and 150° C. and may then be rolled into thin sheets; above 200° C. it is brittle again and can be pulverized. It is one of several metals that can be welded together by the new cold-welding process that uses pressure alone. The vapor is toxic when inhaled and all the soluble compounds are poisonous. See DUCTILITY; MALLEABILITY; WELDING.

Zinc, with a valence of +2, belongs to Group 2 of the periodic table of the elements (see CHEMISTRY; PERIODIC TABLE). This bluish-white metal is very active chemically; the dust may explode in air. The chemical symbol for zinc is Zn, atomic number 30, atomic weight 65.38, melting point 419.5° C. (787.1° F.), boiling point 907° C. (1665° F.), and specific gravity 7.14, somewhat lighter than tin (see ATOM; DENSITY).

Compounds. *Zinc sulfide* (ZnS), *lithopone* (zinc sulfide and barium sulfate), and *zinc oxide* (ZnO, also called *zinc white* and *Chinese white)* are white powders used in large quantities in the manufacture of rubber and auto tires, as pigments in white paint and ink, and as coatings and opacifiers in paper, oilcloth, linoleum, and ceramic products. The crystalline sulfide is used for X-ray and television screens and for luminous dials of clocks and watches. The oxide is used in quick-setting cements, in cosmetics, and as a mild antiseptic and astringent for skin diseases.

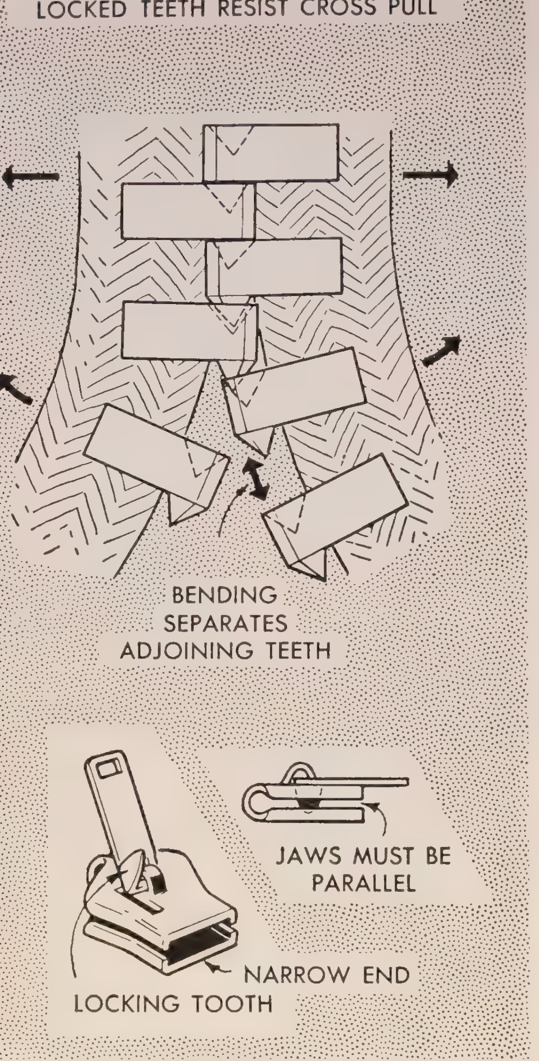
Zinc chloride and *zinc sulfate* are used in preserving wood, skins, and anatomical specimens, electrogalvanizing, making glue, and as mordants in dyeing textiles; the chloride in dry batteries and soldering fluxes, in vulcanizing rubber and fibers, in crimping, mercerizing, and sizing fabrics, and in petroleum refining. Rayon manufacture and agriculture take most of the sulfate output, but large amounts go into production of chemicals, paint, and varnish. Many other compounds of zinc have considerable commercial importance.

Ores. The most important zinc mineral is *sphalerite,* which is zinc sulfide, also known as *zinc blende* and *blackjack.* Zinc carbonate, silicate, and aluminate minerals are also found in zinc ores, often with iron and small amounts of manganese or cadmium impurities. These ores occur in all continents. In the United States the chief mine production is in the tristate area (Kansas, Oklahoma, Missouri) near Joplin, Mo., and in Idaho, Arizona, Montana, and New York. Near the surface in northeastern Washington are zinc-lead deposits, extensive but not rich, with great promise for the future. At Franklin, N. J., are the only known large deposits of *zincite* (the oxide) and *franklinite* (an oxide of zinc, manganese, and iron). Zinc white is obtained from both these minerals and franklinite is a source of spiegeleisen, an alloy used in the production of some steels (see STEEL, *Varieties).* Another valuable source of zinc that occurs chiefly in the Franklin deposits is the silicate mineral *willemite.*

To get metallic zinc from sphalerite, for example, the concentrated ore is roasted in the presence of air, giving impure zinc oxide and sulfur dioxide, from which sulfuric acid may be obtained as a valuable byproduct. The oxide is then heated in a retort or distillation furnace with carbon (coal or coke), which combines with the oxygen of the oxide and frees the zinc. The metal, which is in the vapor form, is then condensed to the liquid state and finally cast in slabs. Zinc of a high degree of purity is obtained by depositing it electrolytically from a zinc sulfate solution (see ELECTROLYSIS).

ZINNIA, *zin' ih uh,* a genus of flowering herbs and shrubs of the composite family, native to the southwestern United States and tropical America. Garden zinnias are descendants of a Mexican species, which in its wild state has daisylike flowers of dull purple. Under cultivation the color range has been extended to include tones of all colors except blue and green, and several double-petaled types have been developed. In height the plants range from twelve inches to three feet, and they are classed as *dwarf, medium,* and *tall.* Zinnias are easily grown and bloom profusely throughout the summer.

ZI'ONISM, or **ZIONIST MOVEMENT,** the movement for the re-establishment of a


LOCKED TEETH RESIST CROSS PULL
BENDING SEPARATES ADJOINING TEETH
JAWS MUST BE PARALLEL
NARROW END
LOCKING TOOTH

Drawings Courtesy of *Popular Science Monthly*

A CLOSE-UP OF ZIPPER TEETH is shown at the top. Below are two views of the slide, which opens and closes the fastener.

Jewish state in Palestine, reached its goal with the founding of the free nation of Israel in 1948. The international body which worked for the creation of Israel and which continued to give support to the new state is the World Zionist Organization.

Ever since Jerusalem was wrested from the Jews by Rome, the Jewish people had dreamed of recovering their Holy City, with its Hill of Zion, the center of their religion. The modern Zionist Movement was dedicated to finding a national home for the persecuted Jews of the world as well as regaining Jerusalem. The founder of modern Zionism was Theodor Herzl, a Viennese journalist, who expressed his ideas in a pamphlet written in 1896. An international Zionist Congress met at Basel, Switzerland, the following year to discuss ways and means of resettling Jews in Palestine. A fund was set up, and money was collected from Jews throughout the world to promote the project.

The Zionists first approached the Turks, who controlled Palestine, and suggested that Palestine might be made a tribute-paying Jewish state under Turkish overlordship. When the Turks refused, the Jews tried vainly to secure from Great Britain a grant of land in the vicinity of Palestine. The British offered them a site in East Africa for a Jewish colony, but the Zionists firmly rejected this suggestion.

Until World War I, Zionist leaders were chiefly interested in developing the physical resources of Palestine, in aiding the Jews who were already there, and in encouraging immigration. With Zionist support, many Russian and Rumanian Jews moved into the land and established colonies. Agriculture, trade, banking, and education were greatly improved. The Hebrew language was revived. At the beginning of World War I, Palestine had about forty Jewish colonies with a population of about 55,000.

After Palestine was freed from Turkish rule, the British Government issued the Balfour Declaration, approving the Zionist plan. The other Allied nations supported the declaration, and with such international recognition, Zionism flourished. The League of Nations in 1920 put Palestine under mandate to Great Britain.

The World Zionist Organization directed the spread of Jewish settlement in the Holy Land. Thousands of settlers came in, and with great energy and enthusiasm began to develop Palestine. The demand for an independent Jewish state did not become really urgent until Adolf Hitler rose to power in Germany and many Jews sought refuge in the Holy Land. The Arabs of Palestine and the surrounding territories were alarmed and angered. Friction between Arabs and Jews finally led the British to restrict Jewish immigration and land purchase.

European Jews were so desperate that many entered Palestine illegally during World War II and afterward. Tensions increased, and open fighting broke out between Arabs and Jews, and between the British and Jewish terrorists. After long months of conflict the British announced their decision to withdraw from the country, and Palestine was partitioned between the Jews and the Arabs. The new state of Israel was founded in May, 1948. The Zionist leader Chaim Weizmann became the first President of Israel, and the World Zionist Organization stood by to offer assistance as the new nation moved toward stability and maturity. See also ISRAEL; JEWS; PALESTINE.

ZION NATIONAL PARK. See PARKS, NATIONAL.

ZIPPER, the popular name for the slide fastener. The modern slide fastener consists of two rows of interlocking metal or plastic teeth, which may be meshed or separated by an especially shaped slide (see illustration). Usually manufactured on tapes, which are sewed, glued, or otherwise attached to the edges to be joined, slide fasteners are used on clothing of many kinds and on luggage, overshoes, tents, sleeping bags, and innumerable other articles. The first slide fastener, an arrangement of hooks and eyes that could be opened and closed by a slide, was invented by Whitcomb L. Judson, of Chicago, in 1891. His attempts to produce a commercially successful device failed, however, and it was not until 1917 that slide fasteners were manufactured on a permanent basis. In 1923 the Goodrich Rubber Company introduced slide-fastening overshoes under the trade name "Zippers." The name was immediately seized upon by the public as the name for the fastener, which it helped to popularize. The zipper can be closed more quickly and easily than buttons or hooks and eyes, and it makes a stronger, flatter, neater closure, one that does not gape and is therefore windproof and rain-resistant.

ZIR′CON. See ZIRCONIUM, *Sources.*

ZIRCO′NIUM, a metallic element discovered in 1789, is more abundant in the earth's crust than copper or tin, but was so difficult and expensive to extract from its ores that it was practically unknown in a relatively pure form until the 1940's. Modern processes produce a lustrous, silver-white metal that can be shaped by forging or made into sheets, rods, and wires (see DUCTILITY; MALLEABILITY). A greatly increased production of zirconium resulted, to some extent, from its promise for use in nuclear reactors for developing atomic power (see TRANSMUTATION OF ELEMENTS, *Fission)*: it has the necessary high melting point (about 1860° C., or 3380° F.) and corrosion resistance and, when very pure, does not readily absorb the slow neutrons needed for producing fission in the reactor.

Properties and Uses. Zirconium has the chemical symbol Zr, atomic number 40, atomic weight 91.22, specific gravity about 6.5, a valence of +4, and belongs to Group 4A of the periodic table of the elements (see ATOM; CHEMISTRY; PERIODIC TABLE). It is very active chemically in the molten or gaseous state and at high temperatures; hence some steps in obtaining the metal are carried out in a high vacuum or in an atmosphere of inert gas such as argon or helium. This activity makes it useful as a "getter" or absorber of gases in vacuum tubes. It is expected to find use in combustion chambers of jet engines and rockets and to be valuable to the chemical industry for piping and tank lining because of its exceptionally high resistance to caustic solutions, dilute acids, and even to hot concentrated hydrochloric and nitric acids. Bone screws, suture wires, wire gauze, and surgical instruments made of it are not attacked by body fluids or antiseptics. The molten metal at high temperatures is used in special lamps to give a brilliant source of light for photomicrography and projection.

Zirconium is added to steels in varying amounts to deoxidize them, refine the grain, or increase the ductility and shock resistance; in some steels it may replace manganese. It increases the strength, toughness, and workability of magnesium alloys for military aircraft, hardens and strengthens brasses and bronzes, and makes useful alloys with gold, titanium, and many other metals.

If zirconium is worked in air while hot it becomes brittle and loses many of its desirable properties. The impure, nonductile metal obtained by the Swedish chemist Berzelius in 1824, and available commercially since about 1930, is a black powder that ignites in air at a relatively low temperature. Since it burns without producing smoke or a corrosive ash, it found use in flashlight powders, flares, ammunition primers, and fireworks.

Sources of zirconium are the oxide mineral *baddeleyite,* occurring chiefly in Brazil, and the silicate mineral *zircon,* found in igneous rocks, crystalline limestones, and in beach and stream sands, often with titanium minerals or gold (see RUTILE). Zircon crystals of gem quality, found in Ceylon, the Ural Mountains, and elsewhere, are known as *hyacinth* when colored red, yellow, or brown; other colors are known as *jargon.* Colorless gem stones rival diamonds in luster and fire but are brittle and chip easily.

Zircon for industrial use comes from Florida, Idaho, California, Oregon, and also Australia. Because of its high melting point, 2500° C. (4532° F.), large quantities are used in making heat-resistant porcelains and refractory brick lining for furnaces to melt glass and aluminum. It also goes into oxides, chemicals, alloys, abrasives, and foundry sand. Baddeleyite has similar uses in ceramics and refractories. The chemically prepared oxide, *zirconia,* is used in quartz ware, to glaze porcelain and make it opaque, and to make a chemical catalyst.

ZITHER, a musical instrument consisting of a shallow sound box over which two sets of strings are stretched. A set of four or five melody strings extends over a fretted finger board; the other set, twenty-five to forty open strings, is used to accompany the melody. The player plucks the open strings with the fingers of his right hand; he presses down the melody strings with his left hand

THE SIGNS OF THE ZODIAC

to alter pitch, while plucking them with a pick worn on the right thumb. Some musical authorities trace the zither back to the psaltery of the ancient Hebrews.

ZODIAC, *zo′dih ak,* a zone or belt in the sky extending for eight degrees on each side of the ecliptic, the path in which the sun seems to move in the course of a year (see ECLIPTIC). Within this same zone the moon and the principal planets also appear to follow a course among the stars.

The ancient watchers of the sky in the Near East noticed that, while most of the star patterns stayed the same, the sun, the moon, and a few bright stars (the planets) seemed to move along a celestial path, returning to their original positions after varying periods of time. In order to locate these wanderers at any given moment, the ancient Greek scientists divided this zone of the sky into twelve sections of thirty degrees. To the group of stars, or constellation, in each section they gave a name, generally that of an animal, and the zone itself was called the zodiac, from the word meaning *of animals.* Each section also had a sign that was used to represent its name. The twelve zodiacal constellations and their signs are, in their order along the zodiac:

♈ Aries, the Ram
♉ Taurus, the Bull
♊ Gemini, the Twins
♋ Cancer, the Crab
♌ Leo, the Lion
♍ Virgo, the Virgin
♎ Libra, the Scales
♏ Scorpius, the Scorpion
♐ Sagittarius, the Archer
♑ Capricornus, the Goat
♒ Aquarius, the Water Bearer
♓ Pisces, the Fishes

Under this system the position of the sun, moon, and planets could be indicated simply by the sign of the constellation in which the heavenly body was located. The sun might be said to be "entering Taurus" or "leaving Aries." The starting point for the zodiacal divisions of the sky was the vernal equinox, the place in the heavens occupied by the sun in March when it crosses the celestial equator. This was called the first point of Aries.

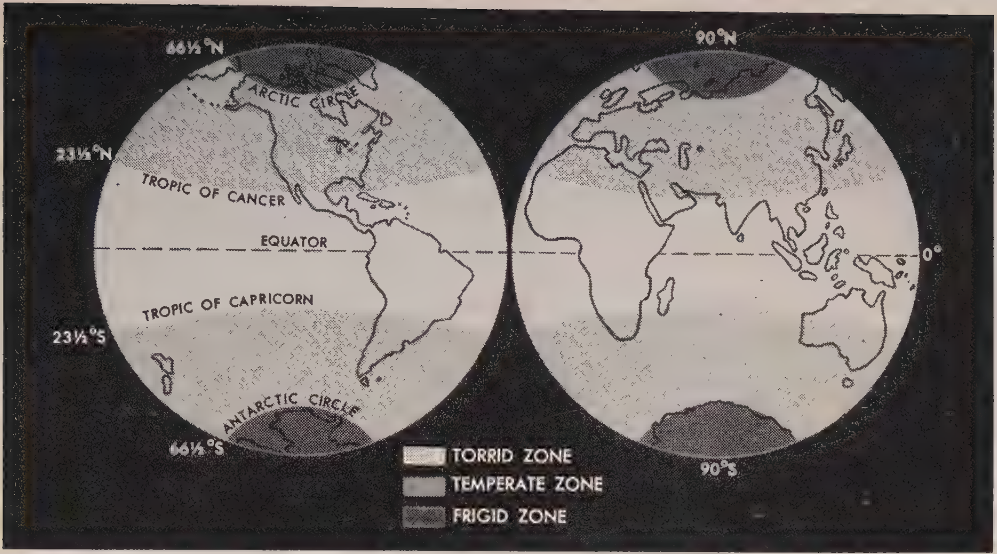
This rather vague way of describing the positions of these heavenly bodies is no longer in general use. Across the two thousand years since the Greeks made their maps of the sky, the vernal equinox has shifted to the west. The first sign of the zodiac no longer contains the constellation Aries, and the rest of the constellations do not coincide with their signs. When an almanac indicates the position of a planet by using the zodiacal sign, it means that the planet is in the section of the heavens corresponding to the sign, not in the constellation of the same name.

To the people who first charted the heavens, each sign of the zodiac had its own meaning and associations. As the sun appeared to move from sign to sign, the seasons changed. Weather phenomena were connected with the signs. People thought that the position of the sun and the planets along the zodiac influenced the affairs of men on earth. This idea developed into the pseudoscience of astrology.

The twelve zodiacal constellations are treated in these volumes under their respective titles. See also ASTRONOMY; EQUINOX.

ZODI′ACAL LIGHT, a faint, hazy wedge of light that is sometimes visible in the west after sunset, or in the east before sunrise, when the sky is clear and there is little or no twilight or moonlight. From its broad base on the horizon the glow extends upward along the ecliptic and hence is seen best when the ecliptic makes a large angle with the horizon (see ECLIPTIC; ZODIAC). In middle latitudes in the Northern Hemisphere the best time of year to look for the evening zodiacal light is about March; in the Southern Hemisphere, about September. The predawn light is best seen six months from these times. In the tropics the luminosity can be seen at any time of the year and has been traced clear across the sky.

Astronomers have shown that the zodiacal light is sunlight reflected from a multitude of tiny dust particles that, like the planets, travel around the sun approximately in the plane of the ecliptic, that is, in the plane of the earth's orbit about the sun. These particles seem to be very thinly scattered over a thin, lens-shaped region of space that ex-



tends outward from the sun and well beyond the earth's orbit. On the ecliptic directly opposite the sun is an oval spot, which is a slightly brighter part of the zodiacal light, called the *counterglow,* or *Gegenschein.* It is presumably due to sunlight that is strongly reflected from particles beyond the earth in the direction opposite the sun, just as it is from the full moon. See also MOON.

ZO'LA, EMILE (1840-1902), a French author, did much to influence the trend toward realism in modern fiction. He grew up in Aix-en-Provence, and in 1858 he was sent to school in Paris. He failed to get a degree and knew real poverty during the years that followed. Finally, at the age of twenty-eight, he began the series of twenty novels that brought him lasting fame. Concerned with five generations of the Rougon-Macquart family, these works were intended to trace, with scientific realism (called *naturalism* by Zola), the manner in which heredity and environment determined the course of human existence.

Zola's novels contained stark, brutal pictures of life among the poor, the criminal, and the oppressed. At their best they had tremendous power, and while they were condemned for their pessimism and their shocking frankness, they attracted millions of readers. Among the best known are *Thérèse Raquin, L'Assommoir, Nana, Germinal,* and *La Terre.* Of Zola's later works the most important were two series: *Les Trois Villes — Lourdes, Rome,* and *Paris,* and *Les Quartre Evangiles — Fécondité, Travail, Vérité,* and *Justice.* The last was unfinished at the time of his death.

In 1898 Zola created a sensation with *J'Accuse,* an open letter to the President of France, accusing the War Department of conspiring against Captain Dreyfus, who had been charged with selling military secrets to Germany. He continued the fight to win justice for Dreyfus despite libel suits, the loss of both his fortune and his popularity, and the danger of physical violence. Finally he was forced to take refuge in England, but he returned a hero in 1899, the year in which Dreyfus was pardoned. See also DREYFUS, ALFRED.

ZOLLVEREIN, *tsawl' fehr ine,* a German word meaning *customs union,* was the name of an economic alliance of the separate German states, formed under the leadership of Prussia in the first half of the nineteenth century. At that time each state, and often each city and province, demanded payment of duty on many articles entering its territory. In 1818 Prussia abolished all customs barriers between the Prussian provinces, and the Prussians soon began to make agreements with the other German states to permit the free passage of goods across state boundaries. The area of free trade was extended until by 1842 it included almost all of the German-speaking states with the exception of Austria and a few independent cities. This economic union paved the way for the political union of Germany some years later. See also GERMANY, *History.*

ZONE, in geography, one of five great regions into which the surface of the earth is divided by latitude circles, that is, by imaginary circles parallel to the equator (see EQUATOR; LATITUDE). The *torrid,* or *tropical,* zone is a belt, 47 degrees of latitude in width, which extends 23½ degrees north and 23½ degrees south of the equator. Its boundaries are therefore the Tropic of Cancer on the north and the Tropic of Capricorn on the south (see TROPICS).

Ewing Galloway, N.Y.

NO BARS ENCLOSE THE POLAR BEARS in the modern Brookfield Zoo. Instead, a deep, wide moat separates the animals from zoo visitors. A low fence keeps onlookers from approaching the moat too closely but does not prevent them from tossing food to the begging bears.

The *north temperate* zone extends from the Tropic of Cancer (23½°N. latitude) to the Arctic Circle (66½°N. lat.). In a corresponding position in the Southern Hemisphere is the *south temperate* zone, extending from the Tropic of Capricorn (23½°S. lat.) to the Antarctic Circle (66½°S. lat.). Between the Arctic Circle and the North Pole is the *north frigid,* or *Arctic,* zone; between the Antarctic Circle and the South Pole is the *south frigid,* or *Antarctic,* zone (see POLE).

This division into latitude zones, a very early attempt to classify climates, is based on the fact that the amount of heat received each year from the sun decreases from the equator to the poles. But this effect of latitude is so modified by altitude, winds, distribution of land and water, warm and cold ocean currents, and other features of a region that temperature and climate may vary considerably around a single latitude circle (see CLIMATE; SEASONS).

The word zone has other uses. Thus in geometry a zone is a portion of the surface of a sphere lying between two parallel planes that intersect the surface in parallel circles. (One plane may be tangent to the sphere instead of intersecting it.) Zones of altitude in mountain regions are also zones of temperature, climate, and plant life. Especially important are the standard-time zones of the world, which have irregular boundaries that lie approximately along longitude circles (see LONGITUDE; TIME).

ZOO, or **ZOOLOGICAL,** *zoh oh loj′ ih kal,* **GARDEN,** a place where living wild animals are kept and displayed. Zoos attract young and old alike, and practically everyone has enjoyed a visit to a zoo at one time or another. The main purpose of the zoo is, of course, to satisfy our natural curiosity concerning unusual living creatures. But zoos also provide us with a great fund of scientific knowledge. Many of them conduct research on the various phases of animal life, particularly animal behavior, and publish their findings. Sometimes the studies made on zoo animals are of use to medical science.

Where the Animals Come From. Zoo animals are obtained in several ways. Many are purchased from professional dealers who collect and transport animals from all parts of the world. Some are presented to zoos by amateur collectors and travelers. Others are animals that have been born in one zoo and sold or traded to another zoo. Occasionally zoological and other societies sponsor expeditions that enable zoo representatives to go out and collect the animals themselves. Rare animals are often obtained directly from foreign game departments. The prices paid for zoo animals vary greatly and depend upon a number of factors. In general, rare animals, exceptionally fine specimens of the commoner animals, and animals that are difficult or expensive to transport call for high prices. Changing world economic conditions also affect the animal market.

The Care of Zoo Animals requires both skill in handling animals and a knowledge of the needs of animals. First of all, each animal must have proper living quarters. Some animals that normally range over a wide territory can be comfortably housed in a comparatively small area. But others, such as elephants and giraffes, because of their size, require plenty of space. Certain tropical mammals and birds may become accustomed to cooler climates and actually thrive in temperatures far different from those of their native haunts. Similarly, arctic animals usually become adjusted to more temperate climates without much difficulty. The cold-blooded reptiles, on the other hand, invariably must be kept in glass-enclosed cages in which the temperature and humidity are controlled to suit the needs of each species. Some of the subarctic animals require air-conditioned cages. Water-loving animals must have bathing tanks in which to swim, and the more active animals need sufficient room for exercise. In all zoos good ventilation and lighting as well as sanitary quarters are of the greatest importance.

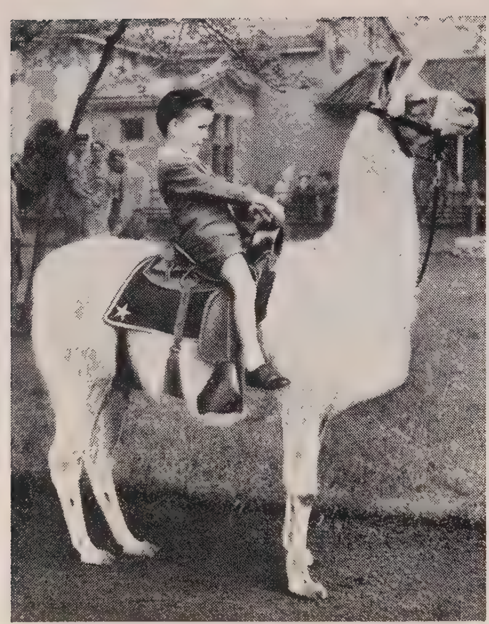
What the Animals Eat. The foods given zoo animals are often quite different from the foods they would eat in the wild. The giant panda, for example, which feeds on leaves and bamboo shoots in its native home, in captivity fares well on a diet of vegetables, fruits, green cornstalks, bread, milk, and porridge. Anteaters, whose natural food consists of ants and termites, thrive on chopped meats and vegetables, dried insects, milk, eggs, and other foods. Some of the meat-eating animals (carnivores) frequently are given bread, fruits, and vegetables in addition to meat and fish. Occasionally a particular species will require a very special diet. Such is the case with the rare Australian platypuses (or duckbills) at the Bronx Zoo. Although these mammals in nature subsist mainly on small aquatic animals, their chief food in captivity is earthworms. Since they require about two pounds of earthworms a day and such continually large quantities of earthworms are impossible to buy, the zoo has had to make special arrangements to raise its own earthworms.

A good-sized zoo not only purchases vast amounts but also a surprising variety of foods for its animals. Among the main items of diet are alfalfa, clover, timothy, corn, oats, seeds, meat, fish, shellfish, eggs, milk, and various fruits and vegetables. To these may be added such delicacies as meal worms, dried flies, frogs, mice, rats, rabbits, and chickens. Cod-liver oil and vitamin and mineral preparations are also essential to the health of many zoo animals. The food must be properly refrigerated or stored and prepared under sanitary conditions. Most of the animals are fed but once a day, a few only once a week, and in the case of pythons at intervals of several months.

Illnesses. Zoo animals must be watched constantly for signs of illness. The diseases that cause the greatest number of deaths

FROM BABY BLACK LEOPARD to hungry hippo, all animals receive individual attention from carefully trained zoo employees.

Acme Photo; New York Zoological Society Photo



New York Zoological Society Photo

A LAD RIDES A LLAMA within view of New York City's skyscrapers. Such mounts as elephants and camels are also available on the remarkable "bridle path" of the Bronx Zoo.

among zoo animals are respiratory diseases, such as influenza, pneumonia, and tuberculosis, and various digestive disturbances. Annoying skin diseases are common among various species, and snakes sometimes get a mouth disease that prevents them from eating. The animals also may break bones, their teeth may become decayed, and now and then their claws or hoofs may need paring. When illness or injury strikes an animal, the zoo veterinarian is promptly called and the latest drugs and methods of medical treatment are used.

Contented Captives. Some people pity zoo animals because they have lost their so-called freedom. To wild animals freedom simply means a never-ending struggle for food and shelter and the ever-present danger of enemies. Animal psychologists have found through experimentation that zoo animals probably are much happier than their wild brethren. They are supplied with plenty of food and given a safe, comfortable shelter. Competition with other animals is practically nonexistent, and probably their only real enemies are the rather rare zoo visitors who tease or otherwise harm them. Once they have become accustomed to captivity, zoo animals seem quite content, and very often they form close relationships with their keepers. Since research is constantly being carried on to improve housing, nutrition, health, and other conditions important to the animals' welfare, the lot of zoo animals promises to become even better.

Zoo Improvements. Those concerned with the operation of zoos are constantly striving to make them more attractive and more educational. In most modern zoos the enclosures in which the animals are kept are carefully labeled. The labels not only identify each animal but also tell the visitor where the animal comes from and some interesting facts about it. Very often the label is accompanied by a colored illustration for easy identification. Some zoos also provide a service whereby the visitor may have his questions answered. Many zoos publish guidebooks, which give additional information about the animals.

TABLE MANNERS AT THE ZOO ARE NOT ALWAYS THE BEST. The young walrus at left gobbles its fish dinner with more enthusiasm than delicacy. At right is a tarsier from the Philippines, one of the rare animals to be found in the better zoos.

New York Zoological Society Photos

New York Zoological Society Photos; Chicago Park District Photo

ZOO KEEPERS HAVE A WIDE VARIETY OF DUTIES. At top left a keeper cleans out the alligator pool. At bottom left a keeper helps to hold a crane while the zoo doctor places the bird's broken leg in a splint. At right a keeper takes two young apes for a stroll.

Perhaps the most striking improvements have been accomplished in the exhibition of the animals. In the more up-to-date zoos, lions, tigers, bears, elephants, and many other animals are shown in barless cages or pits. With this arrangement, the animals live in a spacious area artificially landscaped to resemble their natural habitats. Surrounding the area is an empty or water-filled moat of sufficient depth and width to prevent the animals from escaping. The idea of the moated, barless cage was originated by Karl Hagenbeck, and the first displays of this type were designed by Ursus Eggenschwiler, a Swiss artist.

Lincoln Park Zoo, in Chicago, has a novel cageless "zoorookery," in which spectators can watch and photograph birds moving freely about in a natural wooded area. The birds are separated from zoo visitors by a water barrier, and though they have their freedom, they cannot fly away because their wings are pinioned. In the Antwerp (Belgium) Zoo certain birds are displayed in indoor cages without wires, glass, or other barriers. A beam of light is played on each cage, and the area surrounding the cages is left dark. Since these birds are types that normally are active only during the day and will not fly in darkness, they make no attempt to leave the safety of their lighted cages.

Many other interesting features are offered by modern zoos. Some, like the Bronx Zoo in New York, have set aside areas where children can play with tame animals under the supervision of trained attendants. Others provide elephant and camel rides. At the St. Louis Zoo lions, tigers, bears, elephants, and chimpanzees have been trained to put on circus acts for the public. Several American zoos, among them Lincoln Park Zoo, have had weekly television shows which acquaint viewers with the zoo animals and the activities behind the scenes. In almost all zoos the feeding of the animals is a special attraction for visitors.

History

The idea of keeping animals in captivity is a very old one. The first zoo of which there is any record was the "Intelligence Park," which existed in China during the twelfth century B.C. Historical accounts also show that the ancient Greeks and Romans maintained private collections of animals, and during the Middle Ages many kings and feudal lords had their own zoos. Up to the late eighteenth century, zoos were for the most part privately owned, few ever being enjoyed by the general public. Finally, in 1793 in Paris the Jardin des Plantes, with its excellent collection of plants and animals, was opened to the public. The Royal Zoological Society founded a public zoological garden at Regent's Park in London in 1826. Gradually more and more zoos came into existence.

Today several hundred zoos are scattered over various parts of the world. Some of them are supported by local scientific societies, others by grants from the towns or cities in which they are located. A few are maintained as commercial enterprises.

Famous Zoos. In Canada the outstanding zoos are those at Quebec and Toronto, and in Mexico there is a well-known zoo at Chapultepec. The New York Zoological Garden, popularly known as the Bronx Zoo, is one of the largest zoos in the world. It covers more than 250 acres and is noted for its great variety of animals, some of them quite rare. The oldest zoo in the United States is the Fairmount Park Zoo, founded in Philadelphia in 1874. Some other important zoos are the St. Louis Zoo, Brookfield Zoo, near Chicago, Lincoln Park Zoo, the Cincinnati Zoo, the National Zoological Park in Washington, D. C., and the San Diego Zoo. In South America interesting collections of animals can be seen at Buenos Aires and at Concepción and Santiago, in Chile. Belém, Brazil, has a zoo which displays animals of the Amazon region.

A BABY ELEPHANT RIDES to its zoo home by taxi, but a huge truck is needed to transport older members of the family.

Acme Photo

Europeans are traditionally zoo-loving people and support many excellent zoos. In France the best known are the Jardin des Plantes and the Jardin d'Acclimatation in Paris and the more modern zoo at Vincennes. In England there is, of course, the famous London Zoo in Regent's Park and the spacious Whipsnade Zoo, where animals roam about over several hundred acres of land. Among the other outstanding zoos of the British Isles are the smaller Manchester and Clifton zoos, the Edinburgh Zoo, with its extensive penguin collection, and the Dublin Zoo, where more than a hundred lions have been born in captivity.

In Germany the major zoos are located in Berlin, Frankfort on the Main, Leipzig, Munich, Cologne, and Dresden. Another celebrated zoo is the Hagenbeck Garden at Stellingen, near Hamburg. Founded in 1907 by Karl Hagenbeck, probably the greatest of all animal dealers, it became famous both as a zoo and as a center for the distribution of circus and zoo animals. The Netherlands has two excellent zoos, one at Amsterdam and another at Rotterdam. The most important zoos in Switzerland are at Basel and at Zurich. In Belgium there is the celebrated Antwerp Zoo and in Hungary the Budapest Zoo. Also notable are the zoos at Stockholm, Copenhagen, Moscow, Vienna, Rome, Lisbon, and Madrid.

Asia, Australia, and Africa have a liberal number of zoos. The largest in Asia is at Alipore, a suburb of Calcutta, but zoos have also been established in Bombay, Karachi, Singapore, Jakarta, Soerabaja (Surabaya), Shanghai, and in many Japanese cities. In Australia the Sydney, Melbourne, Adelaide, and Perth zoos are the most notable. Africa's best-known zoos are located at Giza, near Cairo, and at Khartoum, Pretoria, and Johannesburg. In a broad sense, the African game preserves, such as Kruger National Park, are a type of zoo. These preserves are open to the public and afford a view of the animals in their natural habitats.

See also ANIMAL (with list) and articles on individual animals.

Books for Reading and Reference

BRIDGES, WILLIAM. *Big Zoo*. Viking Press. Young readers will enjoy this description of the New York Zoological Park.

BUCK, FRANK. *Bring 'Em Back Alive*. Garden City.

COOK, GLADYS EMERSON. *Zoo Animals*. Grosset. For young readers.

DITMARS, RAYMOND L., and BRIDGES, WILLIAM. *Wild Animal World*. Appleton. Behind the scenes at the zoo.

HUMPHREYS, DENA. *The Zoo Book*. Holt.

ZOOLOGY, *zoh ol′ oh jih,* is the science that deals with the many kinds of animals, their structure, and their habits. Its sister science is botany, the study of plants, and together with botany it makes up the vast science of biology, which is concerned with all living things. See Biology.

Why We Study Zoology. The beauty of some animals, the odd appearance of others, and, above all, the fascinating habits of animals lead many people to study zoology. But there is a far more practical reason for learning this science, and that is that man's health and welfare are in large measure dependent upon animals. The meat, fish, dairy products, and other protein foods so necessary to good health come from animals. Our fur, wool, silk, and leather clothing is provided by animals. Laboratory experiments carried out on animals have made possible the medical and surgical advances that have been responsible for saving so many human lives. Then, too, animals provide us with pets and with such recreations as hunting, fishing, and nature study. In some countries animals even serve as an important means of transportation or as beasts of burden.

On the other hand, animals may invade our bodies and cause disease, or they may carry and transmit other organisms producing disease. They also may ruin our crops and infest our homes. To keep harmful animals under control and to put beneficial animals to the best possible use, one must know something of zoology. And, finally, a knowledge of the structure and functions of the bodies of animals enables us to better understand the workings of our own bodies.

Divisions of Zoology. There are so many phases of animal life to be studied that zoology has, over a period of many years, become divided into a number of subsciences.

The structure, or *morphology*, of animals is dealt with in *anatomy*, the study of gross animal structure by means of dissection; in *histology*, the study of animal tissues under the microscope; and in *cytology*, the study of cells. The functioning of animal bodies and their parts is treated in *physiology*. *Taxonomy* is concerned with the classification of animals and *zoogeography* with their distribution. *Paleontology* is the study of fossil organisms. The development of animals before birth is covered in the subscience of *embryology* and the heredity of animals in *genetics*. *Ecology* deals with the relationship of animals to each other and to their environment. *Parasitology* is the study of animals that live on or in the bodies of other animals and plants, and *pathology* is the study of animal diseases. *Psychology* is concerned with mental processes.

Some of the zoological subsciences deal with particular groups of animals. Among these subsciences are *protozoology*, the study of one-celled animals; *helminthology*, the study of worms; *conchology*, the study of mollusks and their shells; *entomology*, the study of insects; *ichthyology*, the study of fishes; *ornithology*, the study of birds; and *mammalogy*, the study of mammals.

There are also several practical fields of study that might, in a broad sense, be considered divisions of zoology. These include *animal husbandry*, which deals with the production of better domesticated animals; *economic entomology*, which is concerned with the control of insect enemies and insect friends; *wildlife conservation*, the preservation of our wild animal resources; and *medicine* and *hygiene*, which have as their chief aim the preservation of our health. (See also articles on the various subsciences.)

History of Zoology. Although early man struggled against animals in his fight for survival, hunted them for their hides and flesh, and even domesticated a few to aid him in his labors, it is probable that no scientific study of animals was made until the time of Aristotle (384-322 B.C.). It was Aristotle who first observed and described the structure and habits of animals. Unfortunately his proposal that the animal kingdom might be divided into groups failed to stimulate any real progress in zoology. Pliny's *Natural History*, written in the first century A.D., reflects in its descriptions of the most ridiculous monsters the current lack of genuine knowledge and the excess of fantastic superstition. A hundred years later, the medical scholar, Galen, actually dissected animals, but for a long time natural history remained more fantasy than fact.

During the Middle Ages zoology, like other sciences, came to a standstill. In the sixteenth century, however, many of the faulty conclusions of Aristotle, Pliny, Galen, and other ancients concerning anatomy were corrected by the Belgian Andreas Vesalius. Thereafter medical science based on independent research and experiment brought to light more and more knowledge concerning the body, its parts, and their functions. Progress was greatly stimulated in the seventeenth century by William Harvey's discovery of the circulation of the blood and by the invention of the microscope, which made possible the study of animal life never before visible. Among the better-known microscopists of that era were Anton van Leeuwenhoek, Robert Hooke, and Marcello Malpighi.

John Ray, who first defined species as a definite unit for the classification of plants and animals, was followed in the eighteenth century by the Swedish scientist Carolus Linnaeus, who established the modern system of naming living organisms. Further contributions which aid in classifying animals on the basis of their structural similarities and dissimilarities were made by Georges Cuvier, the founder of comparative anatomy. Among the scientists who helped to develop the doctrine that all living things are made up of cells were Matthias Schleiden and Theodor Schwann. Max Schultze went on to establish the fact that protoplasm is the basic stuff of life. Jean Baptiste Lamarck set forth the idea that changes in environment bring about structural changes in animals and that such changes are inherited by their offspring.

In the nineteenth century Charles Darwin's *Origin of the Species* (1859), advancing the theory of evolution, had a powerful effect not only on zoology but on all modern thought. The century also produced the writings on evolution of Thomas Henry Huxley and Alfred Russel Wallace; important work on heredity by Gregor Mendel; observations in embryology by Karl Ernst von Baer; discoveries in bacteriology by Louis Pasteur; and further developments in classification. Louis Agassiz is credited with stimulating progress in the biological sciences in the United States.

Since the beginning of the twentieth century, emphasis in zoological research has been placed upon the study of the cell, experimental embryology, physiology, ecology, genetics, and economic zoology. The layman continues to show his interest in zoology by visiting the zoo and by reading the many popular works on animal life which are published each year. Unfortunately these works are sometimes more entertaining than scientifically accurate, and even today many people cling to superstitious beliefs about animals which were current in the days of Pliny's *Natural History.*

Classification. Just as a librarian places books on the same subject matter into groups, so a zoologist divides the animal kingdom into groups of similar animals. This separation of similar animals into groups is called *classification.* Although attempts to classify living things began as far back as the time of Aristotle, it was not until 1735 that Linnaeus devised the system of *binomial nomenclature* which forms the basis of modern animal and plant classifications.

Linnaeus advanced the idea that plants and animals be given double scientific names derived from Latin and Greek words. The first name of any plant or animal represents the *genus,* that is, the group of closely related plants or animals to which it belongs. The second name represents the *species,* indicating exactly which member of the genus it is. In a sense, the genus is like a person's surname, or family name, while the species is like his first, or given, name. Thus if the name William Jones were written according to the principles of scientific classification, it would appear Jones William, the Jones signifying that he belongs to the Jones family (genus) and the William pointing out exactly which one of the Joneses he is (species).

Unlike the human realm, where there are often many unrelated people with the same name, no two animals or plants ever have exactly the same scientific names. An international commission, founded in 1895, keeps accurate records of all known organisms and carefully checks each report of a newly discovered animal or plant to prevent duplication. If a report on a new organism meets the requirements of the commission, the name of the new animal or plant is added to the records.

Many people wonder why scientists insist on using the scientific name of an animal rather than its common name. In the first place, an animal is often called different names in different regions. Thus the flicker, a familiar bird of the United States and Canada, is also known as yellowhammer, golden-winged woodpecker, yellow-shafted woodpecker, pigeon woodpecker, high-holer, wake-up, and by many other names. Then too, a common name may refer to two entirely different organisms. For example, in the United States the name junco is given to a bird, but in Mexico it refers to a cactus plant. It is obvious, therefore, that the use of scientific names gives each plant and animal a universal, unchanging name that can be understood in any language. Moreover, when translated, the names often give a brief description of the organism.

Animals as a whole are placed in the *kingdom* Animalia, to distinguish them from plants. The animal kingdom is divided into a number of large groups called *phyla* (plural form of *phylum*). Each phylum is subdivided into *classes,* each class into *orders,* each order into *families,* each family into *genera,* and each genus into *species.* Sometimes a species is further divided into *varieties.* This complex system of classification can be best understood by showing exactly how a particular animal is classified. The brown, or Norway, rat *(Rattus norvegicus)* is an example:

Kingdom Animalia. Since the rat obviously is not a plant, it belongs to the animal kingdom.

Phylum Chordata. Because at some time during its life the rat has a supporting rod known as a notochord, it is classified as a chordate animal.

Class Mammalia. Further study shows that the rat has hair and suckles its young. Therefore it is a mammal.

Order Rodentia. The chisel-like incisor teeth or the rat show that it is a gnawing mammal, or rodent.

Family Muridae. Closer inspection of the teeth proves that the rat belongs to this family of Old World rats and mice.

Genus Rattus. Since it is a rat rather than a mouse, it belongs to this genus.

Species norvegicus. Its worldwide distribution and shorter tail identify it as the Norway rat.

ZOOLOGY

The Animal Kingdom

About one million known species of animals exist today. They range in size from microscopic forms scarcely 1/25,000 inch in diameter to the blue whales which may be over one hundred feet long. Animals inhabit almost all parts of the world except, perhaps, the highest mountain peaks. Many are land dwellers, living on or burrowing in the soil. Some live in the oceans or in fresh-water lakes, ponds, and streams. Not a few spend much of their time in the air. A small percentage are parasites, which live on or in the bodies of other animals and plants. The following are the most important groups of animals.

Phylum Protozoa, which gets its name from the Greek words meaning *first animal,* contains the simplest of all animals — those whose bodies consist of only one cell. The protozoans are for the most part microscopic in size and live either as single cells or grouped together in small colonies. Most of the 30,000 or more species inhabit fresh or salt water, but some kinds are found in the blood or body fluids of man and animals. One group of protozoans moves by pushing out projections from the body. Another uses a tail-like structure called a flagellum. A third group has movable hairs, or cilia, for locomotion. Among the well-known protozoans are paramecia, amebas, the species causing malaria, and the trypanosomes responsible for African sleeping sickness. See PROTOZOA.

Phylum Porifera includes about 3,000 different kinds of sponges. Unlike protozoans, these animals are composed of many cells, and their soft, saclike bodies are perforated with numerous small holes, from which they get the name Porifera, or *pore bearers.* Sponges are found in fresh-water lakes and in the ocean attached to rocks and other objects. Their soft bodies are supported by a network of tiny needles, or spicules, made of lime, silica, or an elastic substance called spongin. Sponges have many uses around the home and in industry, and sponge fishing is a profitable occupation in several countries. See SPONGE.

Phylum Coelenterata contains hydras, jellyfish, the Portuguese man-of-war, corals, sea anemones, and related animals. The coelenterates range in size from microscopic forms to species many feet in diameter. Some, such as the reef-building corals, live together in great colonies; others live alone. Although a few inhabit lakes, ponds, and streams, most of the 9,500 species are found in the ocean. The name Coelenterata means *hollow intestine* and refers to the large digestive tract in the saclike bodies of these animals. Two body types, both composed of a double layer of cells, are present in coelenterates. One is a cylinder-shaped *polyp,* which has a circle of tentacles at the upper end and is attached to some object at the lower end. The other type is a free-swimming *medusa,* which is shaped something like an inverted saucer. Many coelenterates are

PHYLUM PROTOZOA
AMEBA

PHYLUM PORIFERA
SPONGE

PHYLUM COELENTERATA
CORAL

PHYLUM CTENOPHORA
SEA GOOSEBERRY

PHYLUM PLATYHELMINTHES
FLATWORM

Rochester Museum of Arts and Sciences, Bausch & Lomb;
Fish and Wildlife Service, U.S.D.A.;
General Biological Supply House, Inc., Chicago

armed with stinging cells for catching prey. See Coelenterata.

Phylum Ctenophora, a small group of about 100 species, contains the transparent, jellylike sea walnuts and sea gooseberries commonly found floating on the ocean surface. The phylum name, which means *comb bearers,* refers to the eight rows of combs extending along the ctenophore's body. Each comb is made up of large hairs, or cilia, which are fused together. By rapidly lifting the combs and then lowering them, the ctenophore moves slowly through the water. Ctenophores were once classified with the coelenterates.

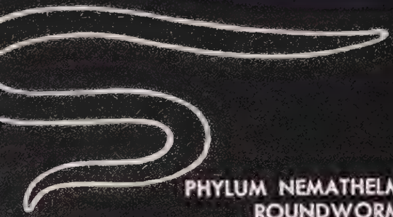
Phylum Platyhelminthes includes about 6,000 species of flatworms. Many are free-living, inhabiting the ocean and fresh-water ponds, lakes, and streams. Some are parasitic, living in man and animals, where they may cause serious disability or even death. For the most part, flatworms have soft bodies flattened from back to front. They have definite head and rear ends, are composed of three instead of two layers of cells, and show the beginnings of the organ-systems found in higher animals. Like the more advanced animals, they are bilaterally symmetrical, that is, the right and left halves of the body are mirror images. Planarians, tapeworms, and flukes all belong to this group.

Phylum Nemertinea, the so-called proboscis, or ribbon, worms, are found mainly in the ocean but also in fresh water and in damp soil. Often brightly colored, their long, slender, flat bodies may reach a length of three feet or more. Contained within the head is a muscular tube, the proboscis, which can be thrust out to catch food. Although they resemble flatworms in many ways, proboscis worms have a primitive circulatory system and a complete digestive system with separate openings for taking in food and excreting undigested materials.

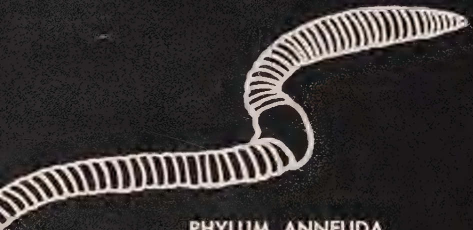
Phylum Nemathelminthes (Nematoda) contains the roundworms, of which there are some 3,500 species. Roundworms are found all over the world in water, in soil, or living as parasites in the bodies of man, animals, and plants. They range in size from tiny threads to species several feet long and usually can be identified by their peculiar way of thrashing about like a whip. Roundworms have a slender, round body, which is pointed at both ends and is covered with a tough skin, or cuticle. Since they have the beginnings of a body cavity (the *coelom* which is present in all higher animals), they are considered more advanced than flatworms. Included in the Nemathelminthes are the hookworm, the trichina worm, and filarial worms.

Phylum Nematomorpha consists of a small group of fresh-water worms known as the hairworms. They are similar to roundworms, but in the hairworms the body cavity is lined with cells, and the free-living adults have a degenerate digestive system.

Phylum Acanthocephala includes the spiny-headed worms which live in vertebrate animals. These worms have a proboscis studded with tiny hooks for clinging to the host's intestine.



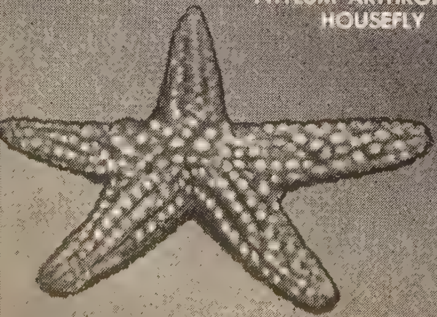
PHYLUM NEMATHELMINTHES
ROUNDWORM



PHYLUM ANNELIDA
EARTHWORM

PHYLUM MOLLUSCA
CLAM

PHYLUM ARTHROPODA
HOUSEFLY



PHYLUM ECHINODERMATA

Bureau of Entomology and Plant Quarantine;
Ewing Galloway, N.Y.; New York Zoological Society Photo

Phylum Rotifera, the microscopic "wheel bearers," are fresh-water animals. They can be recognized by the ciliated discs at the top of the body. When the cilia on these discs are put in motion, the discs resemble revolving wheels. There are about 1,200 species of rotifers, varying in shape from flowerlike attached forms to wormlike types.

Phylum Bryozoa, containing about 1,200 living species, includes both marine and fresh-water forms. Great colonies of these microscopic animals incrust rocks and seaweed, and because of their resemblance to plants they are commonly called moss animals.

Phylum Annelida is the group to which earthworms, leeches, and other segmented worms belong. About 6,500 species are distributed throughout the world, mostly in soil but also in fresh-water lakes and ponds. Annelids not only have a true body cavity characteristic of more highly developed animals but also have well-developed organ-systems. Their bodies are divided into many rings, or segments, and some species are provided with bristles, which act as anchors or aid in locomotion.

Phylum Mollusca contains about 80,000 species and includes such familiar animals as oysters, clams, snails, slugs, and octopuses. The scientific name of the phylum, which means *soft-bodied,* refers to the fleshy bodies of these animals. Mollusks are widely distributed on land and in fresh and salt waters. In the typical mollusk, the body is divided into a head, a visceral mass containing the internal organs, and a muscular foot which is used for locomotion. Covering the visceral mass is a protective membrane, the mantle. Most mollusks have a hard, limy shell of one or more parts which is secreted by the mantle. Mollusks provide us with food, valuable pearls, and decorative shells. A few species, such as the wood-boring shipworm and the snails and slugs which attack vegetation, are destructive. See MOLLUSCA.

Phylum Arthropoda, the largest of all animal groups, contains around 800,000 species and constitutes over three fourths of all known animals. Arthropods live in all parts of the world in a great variety of habitats. Many are free-living, while others are parasites of plants and animals. Like annelids, arthropods are basically composed of segments, but unlike annelids, the segments frequently differ in structure and function. Typically, the arthropod body is divided into a head, thorax, and abdomen and is provided with jointed appendages which have various uses. The body is protected by a heavy outer covering, or exoskeleton, made of chitin. Arthropods are separated into a number of classes, the most important of which are (1) crustaceans, such as shrimps, barnacles, lobsters, crabs, and crayfish; (2) insects; (3) arachnids, including spiders, scorpions, mites, and ticks; and (4) myriapods, which include the centipedes and millipedes. See ARTHROPODA.

Phylum Echinodermata includes about 4,800 species of spiny-skinned animals, like starfish and sea urchins. All echinoderms live on the ocean floor, where they are permanently attached or can move about only slowly. They are unique in that their bodies show five-part radial symmetry, that is, they are built on the plan of a wheel with five, or multiples of five, spokes. They also have an internal skeleton, which consists of limy plates embedded in the soft flesh. Protruding from these plates are spines. Echinoderms also have an unusual water vascular system, which serves mainly as a means of locomotion. See ECHINODERMATA.

Phylum Chordata, containing about 65,000 species, is the group to which man and most familiar wild and domesticated animals belong. Chordates differ from other animals in three respects. First, at some time of life, either before or after birth, chordates have a flexible supporting rod, or notochord, within their bodies. Second, a single, hollow nerve cord runs along the back, or dorsal part, of the body. When present in lower animals, the nerve cord is usually located underneath, or ventrally. Third, at some stage of development chordates have gill slits or gill pouches in the pharynx. In land-dwelling chordates, which breathe by means of lungs, the gill slits appear only for a short time during embryonic development. But in water-dwelling chordates, such as fish, gill slits are present in the adults. Chordates are divided into four subphyla:

Subphylum Hemichordata includes the acorn worms, which live in the sand or mud of seashores. These wormlike creatures have the body divided into a proboscis, collar, and trunk. They have many gill slits, a very short notochord located in the proboscis, and both dorsal and ventral nerve cords.

Subphylum Urochordata contains the sea squirts, widely distributed throughout marine waters. These animals have a tough outer covering called the tunic. Gill slits are the only chordate characteristic seen in the adult sea squirt, but the larval form, which looks like a tadpole, has a notochord and dorsal nerve cord situated in the tail. As the larva develops, it loses its tail, resulting in a degenerate adult without either notochord or nerve cord. See SEA SQUIRT.

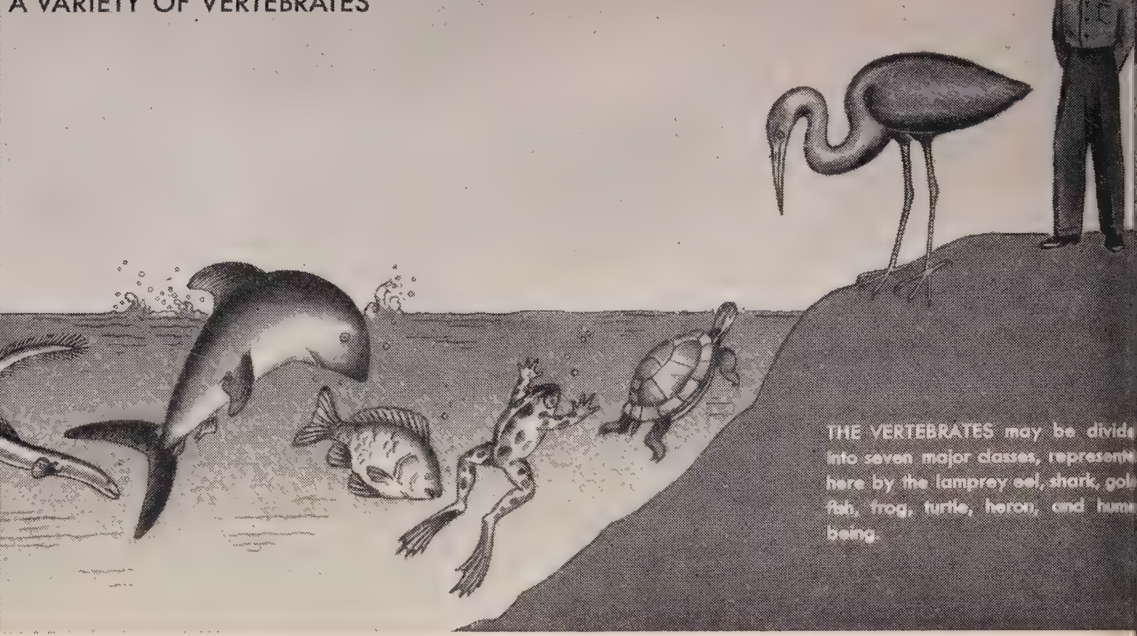
Subphylum Cephalochordata has as its most outstanding member a small marine animal called amphioxus. It is shaped like a lancet and has a well-developed notochord and dorsal nerve cord extending the entire length of the body. Many gill slits are also present, as are segmented muscles.

Subphylum Vertebrata includes a great variety of land- and water-dwelling animals. They have the usual chordate characteristics, but in vertebrates the notochord is replaced by a backbone, or vertebral column, and the brain is enclosed in a case, the cranium. In addition, vertebrates have an internal skeleton of cartilage or bone, a well-organized nervous system and sense organs, internal gills or lungs for breathing, and a closed circulatory system. The most important classes of living vertebrates are:

Class Cyclostomata, the lamprey eels and hagfishes. Cyclostomes lack jaws and have instead a round mouth for sucking the blood and flesh of the fish on which they live.

Class Chondrichthyes (Elasmobranchii),

A VARIETY OF VERTEBRATES



THE VERTEBRATES may be divid into seven major classes, representi here by the lamprey eel, shark, gol fish, frog, turtle, heron, and huma being.

which includes sharks, skates, and rays. Elasmobranchs have jaws, a skeleton made of cartilage, paired fins corresponding to the paired limbs of higher vertebrates, and toothlike scales. See RAY; SHARK.

Class Osteichthyes, the true bony fishes, which resemble elasmobranchs but have a skeleton of bone, gill covers, and usually round, overlapping scales. See FISH.

Class Amphibia, the frogs, toads, and salamanders. Amphibians spend part of their lives in water and part on land. In the water-dwelling stage, they have gills for breathing; in the land-dwelling stage, they breathe by means of lungs and develop two pairs of legs for locomotion. See AMPHIBIANS.

Class Reptilia, which includes lizards, snakes, turtles, alligators, and crocodiles. Reptiles are cold-blooded animals with a scaly skin and four-chambered heart. They breathe by means of lungs. See REPTILES.

Class Aves, the birds. These warm-blooded, feathered animals have the front limbs modified into wings for flying. They lack teeth and have instead a horny bill, or beak. See BIRDS.

Class Mammalia, the mammals. Like birds, they are warm-blooded animals. But mammals are covered with hair, and the females have mammary glands for nourishing their young. See MAMMALS.

Related Articles. In addition to the above references, consult the many articles in these volumes on the individual animals, also the following titles:

Agassiz, Louis
Animal
Aristotle
Biochemistry
Cell
Darwin, Charles R.
Evolution
Galen
Harvey, William
Heredity
Huxley, Thomas H.
Insects
Lamarck, Jean Baptiste
Leeuwenhoek, Anton van
Linnaeus, Carolus
Mendel, Gregor Johann
Parasite
Pasteur, Louis
Pliny
Wallace, Alfred Russel

ZORN, *sawrn,* ANDERS (1860-1920), Swedish painter, etcher, and sculptor, was born in Mora, Sweden, and studied art in Stockholm and London. He became a very successful portrait painter, and did portraits of many writers, statesmen, and artists, including three American Presidents: Cleveland, Taft, and Theodore Roosevelt. After achieving an international reputation he returned to Sweden, where he remained until his death. His work as an illustrator and etcher was highly praised.

ZOROASTER, *zoh roh as′ tur,* the ancient Persian teacher and reformer who founded the faith known as Zoroastrianism. His name is a Greek form of *Zarathustra.* It is not known exactly when he lived, but many scholars place him between 660 and 583 B.C. According to old records and traditions, he was a member of the priestly caste of the Magi. The moral and social reforms he preached were his own, however, and for many years he suffered bitter attacks without winning converts to his religious beliefs. Finally a prince accepted his teachings, and from that time on the new faith spread rapidly. Zoroaster is said to have been killed in one of the conflicts which broke out between his followers and those who opposed the new faith. Some of his teachings are included in the Zend-Avesta, the holy book of Zoroastrianism. See also ZEND-AVESTA; ZOROASTRIANISM.

ZOROASTRIANISM, *zoh roh as′trih an iz′m,* the religion founded by the Persian prophet Zoroaster, centuries before the be-

Santa Fe Railway Photograph

YOUNG MEN OF THE TRIBE perform the Eagle Dance outside a Zuñi dwelling.

ginning of the Christian Era, resembled Christianity in a number of ways. Zoroaster demanded the abandonment of false gods and the worship of the one true God, who created all men. His followers believed that the good would enter paradise and that the wicked would be punished for their sins in hell. Good and Evil, personified by Ahura Mazda, or Ormazd, on the one hand, and by Ahriman on the other, clashed in endless competition for possession of man's soul. Ormazd was the Good, the Truth, the Light, symbolized by the pure element, fire; Ahriman was Evil, Falsehood, Darkness, and Death. Good thoughts, good words, and good deeds were demanded of the human allies of Ormazd. A holy book, the Zend-Avesta, was compiled for the faithful. Zoroastrianism spread over Persia and moved westward toward the Mediterranean. After the death of its founder, however, the faith gradually lost its purity, its rituals and deities multiplied, and its priesthood became increasingly worldly. Moslem persecution crushed Zoroastrianism in the seventh century A.D., but a remnant of the faith has survived in the little Parsee sect of modern India. See also PARSEES; ZEND-AVESTA.

ZUIDER ZEE, *zi'dur za',* a shallow arm of the North Sea that in former times penetrated for about eighty miles into the northwestern part of the Netherlands. Because the Dutch needed more farmlands in order to feed the increasing population, they built a huge dam across the mouth of the Zuider Zee, transforming the salt bay into a freshwater lake, called the IJsselmeer. Large areas along the shores were then filled in to make *polders,* flat farmlands reclaimed from the water. The original plan called for the reclamation of some 550,000 acres, and by the middle of the twentieth century 170,000 acres had been diked and drained. The old Zuider Zee was a famous fishing ground. After the dam was built, herring and shrimp disappeared, but flounder and eels were taken from the new lake.

ZULU, *zoo' loo,* a member of any of the several tribes of Negroid, Bantu-speaking people in southeastern Africa. About 400,000 live in Zululand, a part of the province of Natal in the Union of South Africa. Zulu villages are groups of beehive-shaped, thatched huts set in a circle around the pens where the cattle are kept. In these family compounds, or *kraals,* the Zulus live much as their ancestors did. A Zulu may have more than one wife. He usually pays the bride's father a number of cattle as a bride-price. The Zulus do some primitive farming, but their traditional occupation is cattle raising. Many Zulus spend some months of each year working as laborers in the cities and in the mines, and many have settled on the fringes of the European towns of the Union. In the early part of the nineteenth century the Zulus, who had moved down along the eastern coast of the continent, dominated a large part of the country between the Zambezi River and the Cape Colony. They were a warrior people, and they fought bitterly to keep the Boers and the English out of their lands. They were not subdued until the early years of the twentieth century.

ZUNI, *zoo′nee,* the name of a Pueblo Indian tribe in western New Mexico and the name of their principal town, or *pueblo.* The Zuñi language seems to be related to Hopi but not to other Pueblo tongues. The Zuñi and the Hopi are much alike in their forms of ceremony and government. Both make much of clans that count their descent through women, and the stone houses are the property of the women. Men, although they do the farm work, are chiefly interested in the ceremonials (see preceding page).

The ancient Zuñi villages were the legendary Seven Cities of Cibola, once believed by the Spaniards to be built of gold. Coronado, first armed conqueror of New Mexico, reached the pueblo in 1540. In 1598 the Zuñi lands became part of a Spanish province, and when they came under United States jurisdiction in 1848, the people were guaranteed the rights granted them by the Spaniards. The population has increased until there are more than 3,000 people in the main village and the three outlying ones.

The Zuñi have never given up their elaborate system of religious ceremonies. Their great festival, the Shalako, marks the end of the year and the beginning of the new one. The Indians still plant and tend the corn with sacred ceremonies, but they also grow wheat, and they keep large flocks of sheep and some cattle. The Zuñi are famous for their beautiful silver jewelry inlaid with turquoise and shell in traditional patterns. See also CORONADO, FRANCISCO VÁSQUEZ DE; INDIANS, AMERICAN; PUEBLO.

ZURICH, *zoor′ ik,* LAKE OF. See ZURICH.

ZURICH, SWITZERLAND, the largest city in the country, with a population of about 390,000, is situated at the northern end of the Lake of Zurich. Zurich, which is the capital of the canton of Zurich, is a very old city with a long history of leadership in commerce and in intellectual activities. It is the chief center of banking and finance in Switzerland, and it is also a manufacturing town specializing in textiles and machinery. The University of Zurich, with its noted medical school, and the Federal Institute of Technology, one of the best engineering schools in Europe, draw students from all over the world. Zurich was one of the strongholds of the Reformation, and it is still generally Protestant. The language spoken is German.

Zurich has been an important crossroads of traffic and communication for centuries, for it lies at a point where the natural east-west passageway along the foot of the Alps crosses a major north-south road connecting Germany and Italy. The town was called Turicum by the Romans. It was a free city in the Middle Ages, and it became a member of the Swiss Confederation in 1351.

The Lake of Zurich, about twenty-six miles long and less than three miles wide, runs generally south and east of Zurich. The low hills around the lake are covered with orchards and vineyards, and snow-capped Alpine peaks rise in the distance. In prehistoric times there were a number of settlements of the Swiss lake dwellers along the shores, and relics of these people are on view in the Swiss National Museum in Zurich. See also LAKE DWELLERS; REFORMATION; SWITZERLAND.

ZWINGLI, *tsving′lee,* HULDREICH or ULRICH (1484-1531), a leader of the Protestant Reformation in Switzerland, was born in Wildhaus, in St. Gall canton, and studied at the universities of Vienna and Basel. After entering the ministry in 1506, he served as a priest in Glarus, in Einsiedeln, and finally, from 1519, in Zurich. Early in his career he became known as a brilliant humanist, or classical scholar, a devoted patriot, and a fearless critic of those in authority. Thorough study of the New Testament led him to believe that the religion of the Roman Catholic Church, as it existed in his time, had little connection with true Christianity.

While preaching in the Great Minster in Zurich during the same period in which Martin Luther was openly criticizing the Church, Zwingli, too, attacked abuses in the sale of indulgences and also spoke out against the use of idols in the churches. He not only denied that priests should remain celibate but married, himself, in defiance of church law. In the same year, 1523, he led Zurich and large numbers of the Swiss people out of the Roman Catholic Church.

Demanding a religion growing out of the Bible, Zwingli joined with Luther in abandoning many of the rules and practices in Catholicism, but Luther refused to accept Zwingli's decision that the Eucharist, or Lord's Supper, should be looked upon as a symbolic ceremony. As a result, the two men and their followers remained in separate camps after a last conference at Marburg in 1529 failed to settle their differences. Thereafter, Zwingli's main concern was with the growing conflict between the Roman Catholic and the Protestant cantons of Switzerland. The two sides finally clashed in open warfare. Zwingli, acting as chaplain once more, lost his life in the battle at Kappel in 1531. See also REFORMATION.

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V
VI
VII
VIII
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